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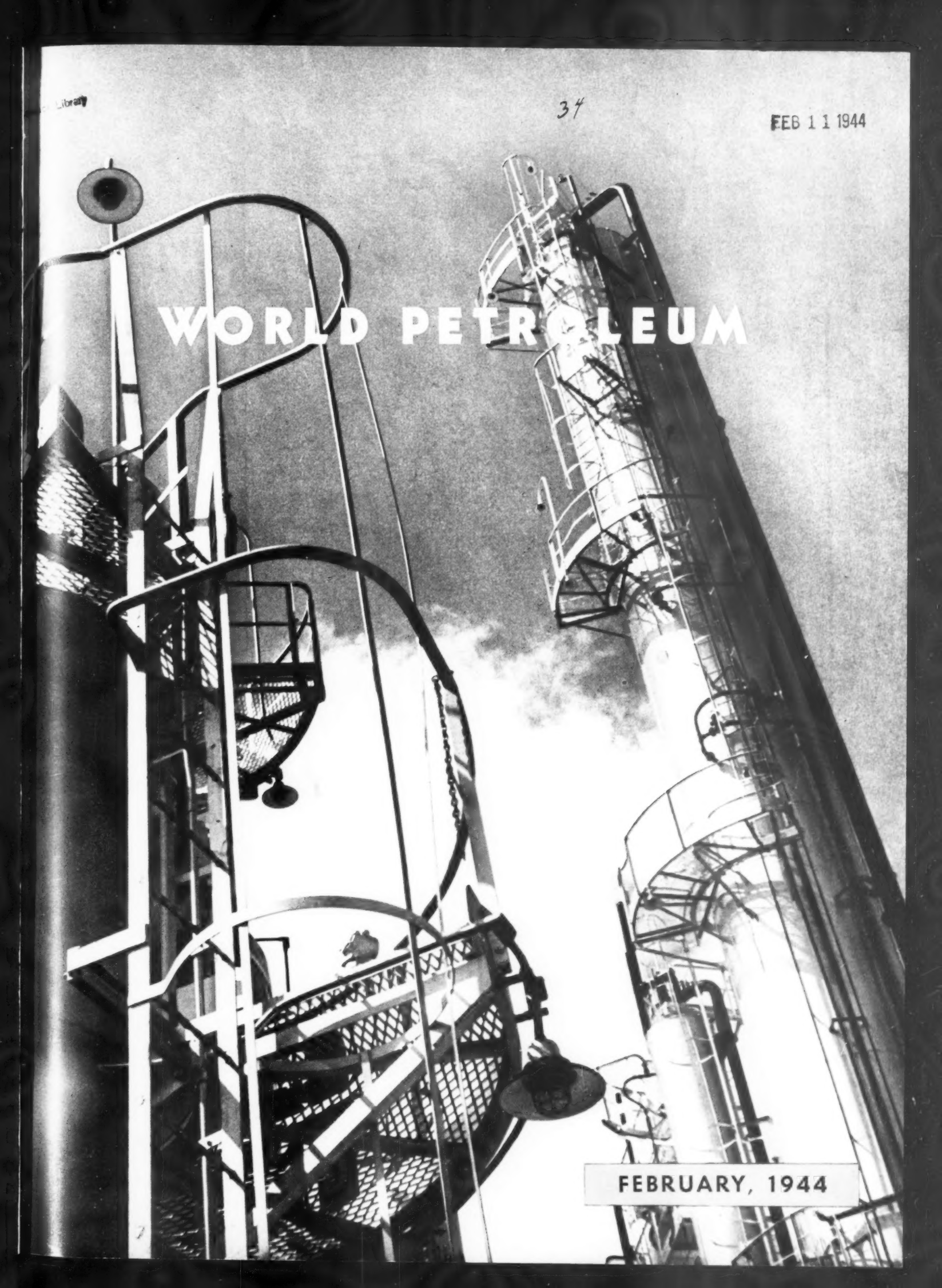

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WORLD PETROLEUM

INCORPORATING PETROLEUM EQUIPMENT EXPORTER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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Official U. S. Navy Photo.

Navy PV-1 Bombers Leading the Way Past 4,000-foot Kiska Volcano.

EDITORIAL

INDUSTRY PARTICIPATION IN NATIONAL OIL POLICY

AMONG the multitude of agencies brought into existence for marshalling the nation's resources for the conduct of the war one of the most successful has been the Office of Petroleum Administration. This is not merely the opinion of those who have participated in its operations but is the expressed view of military men and others who have been brought into contact with many different phases of war activity on the production front. The speed with which the country's refining facilities have been transformed to the provision of specialized war products, the ingenuity that made it possible to meet swiftly mounting military demands during this process of transformation and the resourcefulness that reconstructed the industry's transportation system have been characterized as industrial miracles by these outside observers.

Admittedly, the efficiency with which this agency has functioned has been due primarily to the form of organization adopted. Upon his appointment as Administrator, Secretary Ickes, who had been looked upon as a leading protagonist of government intervention in the production and distribution of petroleum, surprised the industry and disarmed suspicion by announcing his intention of working with the members of the oil industry rather than attempting to dictate to them. In fulfillment of this promise he staffed the organization with men drawn from the ranks of the industry and chosen for their practical knowledge of its operations. He appointed a War Council to act as advisor and established district committees of operating oil men to deal with local problems in different sections of the country.

In its actual working this system has thoroughly justified itself. The Petroleum Industry War Council has taken a very active part in handling the war tasks devolving upon the industry. Through its various committees it has studied the problems that have been raised in the course of the war. It has not hesitated to proffer advice on general policies or to record its criticism of specific measures. The personnel of the various divisions of the Administrator's office have worked in close collaboration with the representatives of the oil industry, have utilized the knowledge of its technical men and have benefited by the readiness of the owners of special processes to pool these in the service of the country. The members of the district and local committees have worked as hard and as zealously in carrying on the public service of their industry as they ever did in the commercial activities of their companies.

All this, of course, is thoroughly familiar to members of the oil industry. The point in recounting it is that it represents, if not an entirely new departure in the relations between private enterprise and governmental authority, at least the establishment of a closer and more far-reaching relationship between the two than heretofore has been attempted. Since industry representation in the councils of government and industry participation in carrying out undertakings in which governmental interests or policies are involved has demonstrated its value in war, the question naturally arises as to why it should not be equally applicable to the solution of post-war problems that already are beginning to take shape.

Apparently, the leaders of the United Nations, and certainly some of those in high official positions in the United States, are convinced that some form of agreement covering international trade in oil is necessary both for political and commercial reasons. Politically it is held essential to the maintenance of future peace that governments which display tendencies toward aggression against their neighbors be prevented from obtaining control of petroleum resources that would enable them to carry out such designs. Commercially it is important to economic and industrial progress that petroleum products be provided in adequate quantity and be equitably distributed. The authority to accomplish these aims clearly must come from an agreement among governments but the actual work of producing and distributing products just as clearly can be accomplished most efficiently by companies and individuals experienced in these operations and possessing the facilities required for them. Both in the shaping of policy and in its execution, the administrative skill and experience of men accustomed to dealing with commercial relations extending across national boundaries would be of unquestioned value.

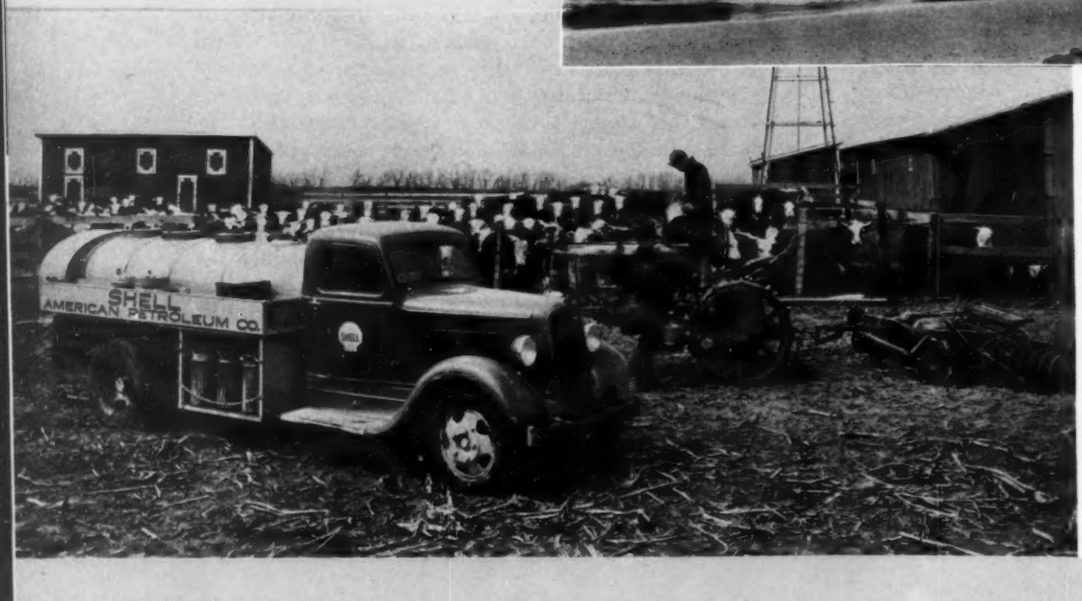
It is in recognition of these dual requirements and of the efficacy of government-industry co-operation in solving post-war problems in their particular industry that the Foreign Operations Committee recently proposed certain recommendations as a basis for a national oil policy. Still more recently their report has received the endorsement of the Petroleum Industry War Council which is continuing to study the subject through a special committee. The recommendations are based upon the experience of various organizations combining the authority of government with the specialized ability of industry representatives in the production and distribution of petroleum products during the war emergency. This experience fully justifies the conclusion stated in one of the final paragraphs of the report, namely that "the American petroleum industry should be admitted more fully into the policy councils of the government of the United States and its ideas and experience should be availed of in a consultative capacity in all policies and measures affecting the future status of national oil operations."

War — Escort Plane Carrier Guarding an Atlantic Convoy.
(Official U. S. Navy Photo)

Peace—30,000,000 Motor Cars Roll on American Highways.

War—Gasoline Going Ashore in New Guinea.
(Photo U. S. Signal Corps)

Peace — Oil Plays Essential Part in Farm Operation.

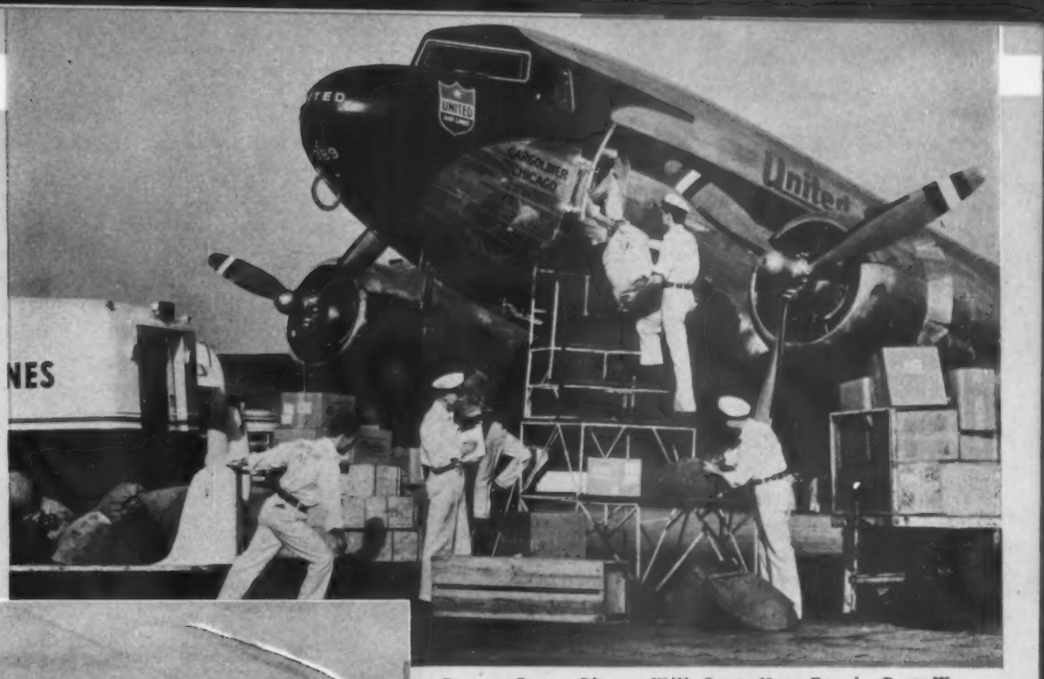


Decisive in War, Petroleum is Likewise a Vital Factor in Preservation of Peace —Industry-Government Cooperation Needed for Efficient Development of Resources and Equitable Distribution of Products.

WORLD WAR I demonstrated the essential part played by oil in modern warfare. The experience of the past four and a half years has shown its overmastering importance. Oil and steel are the twin giants that determine the fate of fighting nations. Without the metals to construct today's powerful engines of destruction and without the oil to fuel them no single political power can hope to wage a successful struggle against opponents who are better supplied in respect of these decisive materials. As has been said repeatedly today's wars are battles of production. The men behind the guns are no less a factor than in the past but their effectiveness depends entirely upon the weapons and materials with which they are supplied. The Polish regiments of cavalry that sought to stay the Nazi invasion of their country in 1939 were not lacking in valor but they were helpless before the dive bombers and mobile artillery of their Nazi assailants. In the final analysis it is the ability to produce the predominant weapons of defense that determines the outcome of any prolonged conflict.

Despite the oft-quoted statement that in 1914-18 the Allies floated to victory upon a sea of oil the fact is that in that contest oil was only beginning to make its real influence felt. Many of the naval vessels of the time and a majority of the merchant ships so essential to the movement of troops and

OIL'S PLACE IN THE POST WAR WORLD



Peace—Cargo Planes Will Open New Era in Post War Transportation. (Photo United Air Lines)
War—Refueling Units Deliver Aviation Gasoline in North Africa. (Official U. S. Navy Photo)

supplies were handicapped by dependence on coal. The struggle of Lord Fisher and a few other progressive spirits to obtain recognition by the British Admiralty of the advantages of liquid fuel was a long one and bitterly contested. It was not until 1915 that the first British battleship built to employ oil fuel exclusively was completed. It was only during the year preceding that the United States put into service the first two of its oil burning battleships. Considering the 50 percent increase in range of action provided by oil, the increased speed and gain in mobility resulting from the ability to refuel at sea it is difficult to realize that only twenty-five years ago a majority of the ships that helped win the war were still hampered by the necessity of employing an inferior fuel. Today the navies of the United Nations are consuming fuel oil at a rate far in excess of its total production in that earlier period. The tanker fleet is as necessary a component of naval operations as the fighting ships and the effectiveness of an equal amount of naval tonnage is far greater than it was in the earlier conflict.

In World War I airplanes played a spectacular but far from a conclusive part. They proved their usefulness in reconnaissance and duels between individual flyers above the battlefronts were marked by inspiring displays of daring. But the planes of that day could not venture far from their bases. They were not numerous enough to operate in large formations. Bombing as now conducted was to be a development of the future.

Even before the outbreak of the present war numerous experts, military and civilian, upheld the view that air power would be a deciding factor, if not *the* deciding factor, in a new world struggle. Doubts expressed by some of them as to the ability of France, Britain and the United States to withstand a German attack were based upon knowledge of the latter's superiority in the numbers and training of its air force. But while the Allies were slow in realizing the crucial need of attaining superiority in the air they have made up for this earlier neglect by vastly multiplying their output of planes and of the superior quality fuel required to operate them until both are far above the productive capacity of the Nazis and far beyond any level they can hope to attain.

Among the ground forces the changes that have taken place in the use of petroleum products between the first world war and the present one are only slightly less sweeping than those that have occurred in air and sea operations. Motor trucks were employed extensively in the earlier period to move supplies from rail heads to the front but the numbers in use at the present time are a hundred times greater as the fighting is spread over a far broader area, much of it in regions where no other form of transportation is available. The tank was introduced as a fighting instrument in the course of the former war but it was in an embryonic stage as compared with the tens of thousands of units of all sizes that have figured so prominently in the current struggle. Other forms of motorized equipment likewise are in far more extensive use at the present time. The measure of difference in this branch of the service is indicated by the fact that a given number of troops now require eighty times the horsepower they were able to use in field operations at the earlier date.

The entire course and trend of the war can be traced with close accuracy by following the part played in it on both sides by petroleum products and the machines that depend upon these products for their operation. In its earlier stages the Nazis won quick and relatively easy victories because they had carefully studied the striking power of motorized equipment and had built up an array of such machines far superior to that possessed by the countries upon which they were to be turned. They had accumulated large reserves of fuel and had organized the most thoroughly trained force of operatives ever brought together up to that time.

In the swift thrust into Poland and in the triumphant progress through the Low Countries and France the great Nazi war machine rolled on with the resistless force of a juggernaut because its opponents had nothing effective to pit against it. Clouds of stuka bombers blazed a pathway of destruction for the onrushing columns of motorcycle troops, motorized artillery and truck borne infantry before which the bravest of brave soldiers bearing outmoded weapons and using the tactics of an earlier day were swept almost as helplessly as leaves before an autumn storm. It was only the stubborn endurance of the British people under the widespread destruction of their homes and factories and the heroic record of the small British air force in exacting a heavy toll of the attacking bombers that prevented Hitler from completing the conquest of all Western Europe.

The unbroken record of successes and the speed with which they had been obtained during the

first year and a half of war undoubtedly helped to inspire the Nazi leader with the Napoleonic ambition of repeating these victories against Russia. Only to the eastward could he hope to acquire the possessions most needed to make his domination of Europe secure—the food supplies obtainable from the rich granary of the Ukraine and the oil of the Caucasus. With these under his control he would be ready to embark on new and broader conquests. Up to this time the Axis position in the matter of petroleum had steadily improved from the inception of the war. Except in the air attack on Britain its losses of planes had been small. In the westward drive during the summer of 1940 it was claimed that the oil supplies captured were in excess of those consumed during the campaign. Meanwhile the entire petroleum production of Europe, natural and synthetic, had been brought under Nazi control. Though this total quantity was no more than 12,000,000 to 15,000,000 tons annually it had proved more than sufficient to destroy the French army and to drive out the British. It was deemed sufficient for a triumphant march across the Soviet Union that would force the Russians back behind the Urals and give the Nazis the food and oil needed to render their position impregnable.

In its earlier phases the project seemed destined for success. The Axis forces, though at heavy cost, engulfed White Russia, the Ukraine and the Crimea, penetrated to the banks of the Volga and the gates of Grozny. In reality the Russian venture was the turning point of the war. It replaced a chain of unbroken victories by an equally consistent succession of defeats. It marked the commencement of a steady deterioration of Nazi petroleum resources measured by the increased demands they were called upon to meet and by a corresponding weakening of Nazi air power which had played such a predominant part in earlier successes.

During 1943 the conversion of Allied industry, and particularly the industrial equipment of the United States, to war production reached a point where it was turning out planes and other motorized war machines at a rate five times as great as the highest figure ever reached by Nazi dominated Europe. By the end of the year a veritable flood of petroleum products was being poured out to enable these weapons of destruction to be used with full devastating effect. Enough 100-octane aviation gasoline is being produced to speed thousands of planes daily and nightly on bombing missions over Europe while maintaining powerful attacks on a score or more of other fronts. Exact figures of the extent of military use of this and other petroleum products are kept secret for obvious reasons but it is reasonable to estimate that the Allies are devoting to direct war purposes ten times the quantity of oil available to Hitler for all the requirements of the lands under his control. This is a rough measure of the degree to which the scale has tipped against the originator of the blitz. As the experience of two world conflicts has demonstrated no nation or group of nations can expect

Peace—Motor Trucks Will Carry a Growing Proportion of the World's Freight.

War—Navy Air Transports Use Much Fuel; Carry Men and Supplies.
(Official U. S. Navy Photo)

War—Unloading Fuel Drums at a Pacific Base.
(Official U. S. Navy Photo)

Peace—From This Terminal Petroleum Products Are Shipped to All Parts of the World.

War—Servicing an Avenger Plane in the Solomons. (Official U. S. Navy Photo)
Peace—Modern Industry Depends on Oil Fuel.

to win such a struggle without possession of petroleum resources equal or superior to those that can be marshalled in opposition. But if control of oil is a requisite to success in war is it not equally essential to the maintenance of peace? What that peace is to be like and how it is to be maintained has not yet been finally determined but the principles on which it is to rest have been discussed among Allied leaders, various blue prints of proposed plans have been drawn and the outlines of a hoped-for structure are beginning to emerge.

Naturally enough there are variations in the plans projected for keeping the world free from war but there is a basic similarity between most of them. They envisage an international assembly in which those countries that have subscribed to the agreement of the United Nations will be represented, together with such of the present neutrals as may care to join and providing for ultimate admission of those who now are fighting on the side of Totalitarianism after they have given convincing proof of the abandonment of aggressive designs upon their neighbors. The animating cause which is expected to make such an organization function is the existence of a spirit of good will among its members, the maintenance of opportunities of economic progress for small as well as large nations and suppression of the practices and policies which have been shown by experience to lead inevitably to war. This all sounds very much like a revamping of the League of Nations, but the architects of a new world have not overlooked the fact that the League failed because it had no power to enforce the will to peace which existed among the majority of its members. When it sought to restrain some one country from infringing the rights or attacking the territory of another the offending government could defy the League with impunity or could resign and take itself outside League jurisdiction as the members of the present Axis group actually did.

To avoid this kind of breakdown it is proposed to prevent the rise of aggressor nations and to do this by withholding from them the means of building up armies and of waging war. At the conclusion of the present struggle, for example, it is assumed that Japan and Germany will be disarmed and prevented from evading or openly disregarding such promises as they may be required to make, as Germany did after World War I. A number of suggestions for accomplishing this result have been put forward. While presumably the decision as to any restrictive measures to be adopted would result from agreement among the members of the entire group the main responsibility for enforcing them probably would fall upon a few of the stronger powers possessing military, naval and air strength sufficient for the purpose. In the discussions that have gone on among the representatives of the larger nations the United States, Great Britain, Russia and perhaps two or three others seem to be cast for the principal roles in the matter of providing the means of enforcing peace, particularly during the period immediately following this war. Such a plan represents a reversion to power politics but the justification offered is that it would be the exercise of power for the good of all rather than for the aggrandizement of any one nation. It is obvious that some means of restraint must be devised that can be used against any government harboring designs against the general peace. Specifically it must be prevented from building up a formidable army or air force or acquiring control of petroleum resources sufficient to carry on an offensive war. Another phase of the task of preventing future outbreaks is the maintenance by the larger powers of naval and air strength sufficient to discourage ambitious aggressors. Because of their positions and the nature of their interest this task is likely to devolve largely upon the United States and the British Commonwealth. It already has been proposed that the mandated islands of the Pacific which were put under Japanese charge after World War I be turned over to the United States for use as naval and air bases. In any event the possession of many such bases, both in the Atlantic and Pacific, will make it essential for the country to have access to petroleum supplies within convenient reach of these bases.

Aside from these political considerations the economic importance of oil, now greater than ever before, the absolute dependence upon it of the transportation of the future and the necessity of providing for the broad and equitable distribution of its products in order to assist in rapid agricultural and industrial reconstruction after the war make it practically certain (1) that a tremendously accelerated development of the world's oil resources will take place as soon as peace returns and (2) that some form of international regulation to insure the equitable distribution of oil products will be established. The only question remaining open is whether the international oil trade is to be managed directly by a number of governments or whether it is to remain a matter of private enterprise operating through some form of authorized association which shall preserve the rights of individuals while carrying on its activities according to general principles and a body of rules approved by the governments concerned.

Advocates of government ownership and operation of oil facilities in foreign lands base their case largely upon the claim that if a government, that of the United States, for example, owned oil properties in any part of the world it could enforce its rights and title—by the exercise of force if necessary—whereas, if such ownership rests with its nationals the government is restricted to diplomatic representations which might or might not be heeded. Against this stands the obvious fact that possession of such property under the flag of another nation would open the way to involvement in the internal and external political disputes of that nation. No sovereign power will invite or tolerate outside interference in its affairs, which is one very good reason why many countries have laws forbidding participation by alien governments in the exploitation of their natural resources. Ownership by the British government of a controlling interest in the Anglo-Iranian Oil Company is sometimes cited as an example of government participation that has worked smoothly and advantageously but important points overlooked in using this illustration are that the government's participation is merely that of a shareholder, that the company is directed by private management like any other corporation and that when the ruler of Iran cancelled the company's concession a decade ago the British government took no part in the dispute but left it to be settled by agreement between the representatives of the oil company

and the Shah. The political system of the United States is not adapted to financial partnership between the government and private capital—still less to governmental conduct of commercial operations abroad as the controversy over the Army's Canadian oil project—undertaken purely as an emergency war enterprise—clearly proves.

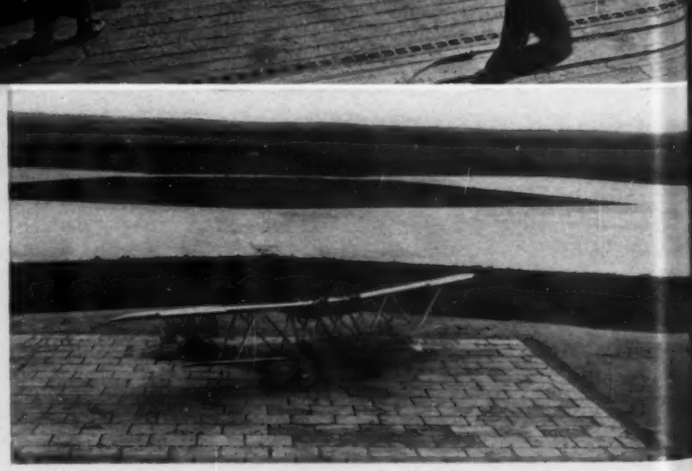
An entirely different treatment of anticipated post-war conditions has been put forward in a report prepared by the Foreign Operations Committee of the American oil industry which has now received the endorsement of the Petroleum Industry War Council. This proposal looks to the establishment of an International Oil Council following somewhat the pattern of the Interstate Oil Compact between oil producing states of the Union. It would provide a general conference made up of representatives of the adhering countries to determine general policies and to provide the authority necessary to the operation of the plan. Actual functioning of the project would rest with a Permanent Commission composed of representatives of the chief consuming countries and representatives of industrial oil organizations in the principal oil producing countries. Subsidiary to the Permanent Commission would be a series of Regional Councils similarly made up of representatives of government and industry to deal with local and regional conditions. A Technical Institute and an arbitral tribunal to adjust disputes are other features of the plan.

The purpose of this proposal clearly is to retain the actual conduct of the international oil business in the hands of the representatives of industry subject to such governmental supervision as may be needed to assure fair play and an equitable distribution of supplies according to relative needs, the avoidance of price wars or the rise of monopolistic control and the practice of sound conservation in the development of a natural resource of vital importance to the economic progress of the world. Whether such a project can be successfully implemented will depend upon the extent of good-will and readiness for cooperation that prevails after the war. The various organizations, official and industrial, which have directed the flow of petroleum products to allied and neutral nations during the war have worked smoothly and with little criticism. If the same spirit that has directed these operations can be maintained following the war the projected plan may be workable.

Certain fundamental considerations must be recognized in any scheme of international oil regulation. No nation possessing oil resources is going to permit any outside authority to tell it how these are to be managed. No government that believes in the possible existence of unproved oil deposits is going to delay the search for such deposit and their exploitation if found because it might be to the advantage of the rest of the world to have their development deferred. Any scheme for regulation of the international oil trade therefore must leave to individual producing countries the methods and policies to govern the handling of their own oil resources. Countries producing solely for their own use and able to provide sufficient for their own requirements—as was the situation of Russia—in the pre-war period—might see no reason for entering into an international consortium. On the other hand exporting nations and those that must depend upon imports for part or all of their supplies might find a definite advantage in an association of oil interests that would direct its efforts to the maintenance of a reasonable balance between demand and supply and to assuring an equitable distribution of products. Such an association, operating with a minimum of governmental interference, would not need to stifle individual initiative or to suppress competition while it could stimulate the industrial growth and economic progress so dependent upon oil in the present stage of world development.

Since control of 90 percent of known oil resources is in the hands of nations already committed by their declarations to the preservation of peace in the world the political objective of preventing the use of oil to build up powers of aggression can be attained by agreement between these nations or even among a small group of leading powers among them. The commercial problems of international oil distribution can be left with entire safety to the men who developed this business to a state of high efficiency before the war and to others who may wish to engage in it. Their primary incentive will be to promote the widest possible use of oil, to improve the quality of its products, to maintain equal opportunities for those who are prepared to play the game fairly and to discourage those who will not. In the attainment of these ends they may be helped by an association that will provide a forum for discussion, a mechanism for the reconciliation of differences and a system for the promotion of orderly trade. That is about as much as an international convention can hope to do.

War—Assembly Line for Destruction — Hellcats Prepare to Take Off from a Carrier. (Official U. S. Navy Photo)



Peace—Air Lines Will Cobweb the Globe—Commercial Plane at a Middle East Landing Field.

NATIONAL OIL POLICY COMES TO FORE IN INDUSTRY-GOVERNMENT DISCUSSION

Petroleum Industry War Council Goes on Record Against Government Participation in Oil Enterprises and Establishes Special Committee to Consider Foreign and Domestic Policy.

WASHINGTON

Oil policy—not only the government's course in dealing with foreign oil developments but also in providing the country with the supplies needed to meet any future emergency that may arise—has been a main topic of discussion during the past fortnight, both among members of the industry who have gathered here and among officials who have to consider oil in its relation to the war, to lend-lease and to future international relations. It received more attention than any other subject brought up at the January meeting of the Petroleum Industry War Council and it has attracted the notice of committees of both houses of Congress, leading to the appearance before these committees of representatives of two important departments to explain certain matters of which more is likely to be heard later on.

PIWC's concentration upon questions concerning the government's relationship to oil came about naturally enough as two features scheduled for its attention bore directly on the subject. One of these was the report of a special committee appointed at the last 1943 meeting to consider the recommendations put forward by the Foreign Operations Committee in relation to foreign oil. The second was a heart to heart talk by the Petroleum Administrator which was not covered by a press release.

According to advance rumors it was the purpose of Mr. Ickes to sell the members of the War Council on the necessity of a government operated Petroleum Reserves Corporation to assure ample petroleum supplies for the country's use in case of another war. From piecemeal reports that trickled out of the meeting, however, it appears that the Secretary devoted most of his long talk to posing various phases of the post-war problems of oil as they presented themselves to him. Among these he included the unbalance resulting from shrinking reserves and expanding demand, the question of exports and imports, the feasibility of holding in storage sufficient supplies to cope with any sudden emergency and the possibilities of developing larger crude reserves. He ended by recommending that these and related subjects be given careful study and suggested that the Council request its chairman to appoint a special committee to consider these subjects. This the Council proceeded very promptly to do.

In submitting its report on the proposals advanced by the Foreign Operations Committee the special committee appointed earlier stated that it had carefully considered the problem of foreign oil development, had reviewed the document prepared by the Foreign Operations Committee and recommended approval of the following report:

"That the oil resources of the world can best be developed by private enterprise under a free economy;

"That a foreign oil policy should be established at once by the United States;

"That such a policy should involve strong support by our government to our nationals who are willing and able to play an important role in the development of the oil resources of the world;

"That our government should not participate either directly or indirectly in the ownership or operation of foreign properties.

"That the report of the Foreign Operations Committee is a sound and constructive presentation of the opinions held by this committee.

"That the report outlines factors that create an international oil problem; emphasizes the special interest of the United States in oil; presents in some detail the principles that should underlie a sound foreign oil policy; and outlines those aspects of the problem that require immediate attention as well as those which should be dealt with under a long term policy. The report vigorously presents the advantages of private enterprise in foreign oil development, points to the great achievements already made by American nationals in this field, and gives convincing arguments to show that direct or indirect participation by the United States government in foreign oil developments will hamper the diligent and efficient prosecution of such developments, will be a long step away from democratic procedure, and will lead to endless political and international complications.

"The Committee finds itself in accord with the substance of the report and endorses its findings as expressed in Sections I to V inclusive.

"With regard to Section VI which gives the design of a proposed international oil compact, the Committee has not completed its study and expresses no opinion at this time. It feels that no immediate action on this particular point is required, as the nature and scope of this compact will in any event postpone its implementation until the world is again at peace.

"The Committee urges that the report of the Foreign Operations Committee be given the widest publicity both within the oil industry and among citizens in general. These matters concern not only the oil industry but the entire nation."

The report was adopted and at the same time approval was given to a set of resolutions of similar import passed by the Board of Directors of the Independent Petroleum Association of America which is as follows:

Whereas, private capital, individual initiative, and free competitive enterprise have achieved the highest degree of development in exploration, production, refining, marketing, and transportation in the oil industry, and in the advancement of the associated sciences, resulting in constantly improving quality, and in reasonable prices to the consuming public in the United States; and

Whereas, the helpful functions of government are recognized in the promotion of conservation, through those governments having jurisdiction, in the prevention of waste, and in the scientific ascertainments of consumptive demand; and

Whereas, in the foreign field, private enterprise has extended the sphere of American industrial power and prestige in the discovery and development of oil reserves with substantial benefits to the United States government, and to its nationals, without the involvement of the United States government as such, and without creating the hostility of friendly nations through the attempted impairment of their sovereignty by the intervention of the United States in their internal affairs; and

Whereas, government control, whether effectuated through government monopoly, government expropriation, or through the nationalization of petroleum has hampered, obstructed, and restricted petroleum industrial development in other countries as compared with, and measured by the achievements of private capital, private initiative, and private management in the United States, and

Whereas, foreign exploration, production, transportation, and refining of petroleum has been dependent, to the greatest extent, upon the advances made by the petroleum industry in the United States in petroleum production and refining technology, and in the improvement made in the art of oil finding, and in the use of American manufactured equipment and supplies; and

Whereas, no major development in the history of the oil industry throughout the world has resulted from purely governmental activity, comparable to the progress made in the industry by private capital and private enterprise; and

John A. Brown—Chairman Committee on National Oil Policy.

Whereas, national defense and national welfare and friendliness between nations are best promoted and served by the extensive and efficient development of petroleum through the media of private capital, private initiative and private management in a free competitive system susceptible of quick mobilization for national service; and

Whereas, a virile, dynamic domestic oil industry in the United States, supported by the legitimate diplomatic aid of the government of the United States to its nationals engaged in foreign operations under established international law constitutes the most indispensable and effective bulwark of national defense;

Therefore, be it resolved by the Independent Petroleum Association of America that: (1) The government of the United States of America be, and it is hereby petitioned, to establish and maintain a consistent foreign oil policy (a) by giving necessary and legitimate diplomatic support, under the principles of international law, to its nationals engaged in foreign oil operations; and (b) by fostering the private enterprise of its nationals in foreign exploration, production, transportation, refining and marketing of petroleum and its products; and (c) by the establishment of a cardinal principle in such foreign oil policy of the government of the United States that the government itself will not directly or indirectly engage in foreign oil ownership, exploration, development, or operation, either in its sovereign or proprietary capacity, or through the media of ownership in corporations or other agencies engaged in the petroleum industry.

In view of the broadened aspect given to the subject by the suggestions of Secretary Ickes the Council decided on setting up an enlarged committee to deal with questions of governmental activities in connection with oil and of government-industry relationships to make this a Committee on National Oil Policy rather than to confine it to matters relating directly to foreign oil. The membership of this committee as announced by Chairman Wm. R. Boyd, Jr. of PIWC is as follows: John A. Brown, president, Socony-Vacuum Oil Company, Inc., chairman; Otto D. Donnell, president, The Ohio Oil Company; J. Frank Drake, president, Gulf Oil Corporation; Wm. H. Ferguson, executive vice-president, Continental Oil Company; Walter S. Hallanan, president, Plymouth Oil Company; George A. Hill, Jr., president, Houston Oil Company of Texas; Eugene Holman, vice-president, Standard Oil Company (New Jersey); W. F. Humphrey, president, Tide Water Associated Oil Company; J. C. Hunter, president, Mid-Continent Oil & Gas Association; A. Jacobsen, president, Amerada Petroleum Corporation; W. Alton Jones, president, Cities Service Company; John M. Lovejoy, president, Seaboard Oil Company of Delaware; Albert C. Mattei, president, Honolulu Oil Corporation; Chas. F. Roeser, president, Roeser and Pendleton; Robert E. Wilson, president, Pan-American Petroleum and Transport Co.; Ralph T. Zook, president, Independent Petroleum Association of America.

Thus the petroleum industry, through its representative and recognized spokesmen in the war councils of the nation, has taken its stand in opposition to the ownership or participation by their government in foreign oil undertakings, in favor of the encouragement of private enterprise in such developments and in requesting the exercise of the influence of government in assuring to Americans equal rights and opportunities with other nationals in conducting oil enterprises outside the borders of their own country. This provides a general platform on which the policy committee now established may be expected to build by the study of specific questions and by recommendations as to the course which should be followed in formulating a sound petroleum policy both in relation to domestic and international oil development. In its consideration of policy proposals relating to the international industry the committee will not be limited to the exact recommendations of the Foreign Operations Committee's report but presumably will proceed within the general framework outlined in that report which summarizes in Section IV the conditions requiring immediate attention and the essentials of a policy to deal with these. The portion of the report is as follows: "The needs of the United States in respect to the development of the world's oil resources combine both immediate and long-range problems. These problems are interrelated, for steps taken in the direction of resolving problems of present urgency may set the pattern for the continuing oil policy of this country. Measures initiated under the stresses of war conditions and during the period following the end of hostilities, should be consistent with the longer-run interests of this country.

"A sound foreign oil policy for the United States will envisage not only the adoption of well conceived principles but also their ultimate implementation through machinery of international understanding. Time will be required for the establishment of an agency of international coordination and consultation, and in the interim the government of the United States will have to act on oil matters and make decisions of grave import.

Changed Conditions Require Changed Policies:

"The war has brought about radical changes in the status of the United States in respect to the oil resources of the world:

(a) The United States is faced with the prospect of shifting from the status of a net exporter to that of a net importer of oil, thus bringing into view the possibility of partial dependence upon foreign sources of supply.

(b) The advances in military techniques, especially in naval operations and aviation, have emphasized the need for far wider availability of oil facilities and supplies throughout the world than heretofore.

(c) In the face of enlarging requirements, there has been an accelerating growth of restrictive measures, narrowing the opportunities for the development of the world's oil resources.

"A Foreign Oil Policy Must Be Established at Once if the Interests of the United States Are Not To Be Sacrificed:

(a) The combined domestic and foreign oil reserves held by nationals of the United States constitute a smaller proportion of the petroleum reserves of the world than the ratio of United States consumption of petroleum to total world consumption. Action is needed to enlarge the reserves under the stewardship of nationals of the United States, and to encourage the retention of existing contracts.

(b) Nationals of the United States should not be in a position of inferiority in acquiring and developing petroleum reserves within the territories or spheres of influence of other nations.

Private Enterprise Is the Best Medium for Oil Development:

"Of the three possible methods for developing the oil resources of the world—government operation, private enterprise, and mixed operations—private enterprise is the surest and soundest choice.

(a) Private enterprise has developed the requisite managerial skill and operating knowledge, and is already well-established.

(b) Private enterprise can operate with a minimum of political complications, as most foreign countries readily admit foreign capital but few countries, if any, would look with favor upon operations by alien governments.

(c) Operations of United States oil companies are at present well-nigh worldwide in scope. This is a major factor in effective national defense and will be a major factor in facilitating peaceful commerce.

(d) The greatest immediate need on the part of private enterprise is the assurance of our government that it will seek to reduce the political risks involved in the use of private capital abroad, and that it will take no steps to discourage the efforts of the nationals of the United States to maintain an effective and serviceable oil industry in foreign countries.

Bare Essentials of an Immediate Foreign Oil Policy:

"The principles regarded as essential to the welfare of the United States in respect to oil are given in detail in the preceding pages of this document. The principles of more immediate urgency may be summarized as follows:

(a) The American petroleum industry should be encouraged to expand its plans for developing the world's oil resources. This encouragement requires assurance that nationals of the United States will receive the cooperation of our government in securing a position of equal opportunity with the nationals of other countries and that the government itself will not enter into competition with its own nationals.

(b) Existing handicaps in the oil operations of our nationals abroad should be examined in the light of their incidence upon our national welfare, and efforts should be made to remove such handicaps as originate in the laws and practices of the United States. American nationals operating abroad must be able to comply with the laws and customs of foreign countries without incurring the risk of violating American laws.

(c) The diplomatic support accorded to our nationals by the government of the United States should be as effective as that accorded to nationals of other countries by their respective governments.

(d) The ultimate disposition of oil facilities and supplies developed or paid for abroad by the government of the United States in the course of the war should be so designed as to promote the interests of our nationals in the postwar world.

(e) Our foreign oil policy should also include appropriate measures for the return after hostilities of American-owned properties, rights and interests in Axis-held territory; adequate compensation for assets destroyed and damaged; and assurance of an early commercial operation of returned properties."

Meanwhile the outlook for Petroleum Reserves Corporation as the medium for directing the interests of the United States in oil development outside the country does not grow brighter. PRC President Ickes has met with no particular success in efforts to induce American companies holding foreign concessions to accept the government as a partner. Sentiment in the industry is solidly against the government's embarking in the oil business either at home or abroad. The State Department, within whose precincts the original plan for PRC originated, seems to have become decidedly lukewarm toward it since it was put under the direction of another branch of the administration. State Department officials are unwaveringly insistent that everything pertaining to or affecting foreign relations shall remain under their supervision and they foresee endless complications if other governmental agencies engage in operations which may raise issues with foreign governments. The Department does not engage in altercations with those who attempt to infringe on its prerogatives but the fate of BEW stands as an example of what is likely to happen in such cases.

Furthermore, the views of some close advisers in inner administration circles and perhaps those of the President himself on the size and urgency of the nation's oil problems are believed to have undergone a change in recent weeks. Possibly they may have been influenced by developments in connection with the conferences in Cairo and Teheran. While the idea of some sort of international agreement relating to the provision of access to oil and to the equitable distribution of its products has not been abandoned there seems to be a greater appreciation of the importance of action by the United States, regardless of such international organization as may be set up, to protect its national interests in the matter of oil supplies both at home and abroad coupled with a realization that this may be accomplished more effectively in the international field by obtaining assurances of fair treatment and equal opportunity for American oil men to exercise the ability and enterprise that have kept them in the forefront of oil development in the past. It is recognized that the leading powers among the Allies, notably Russia and Great Britain, have definite policies of their own which they intend to pursue and that while they may be willing to participate in plans for orderly direction of international oil trade they do not intend to let these interfere with the possession and utilization of oil resources considered necessary for their domestic economy and national protection and it is considered that there is every reason why the United States should follow a similar course.

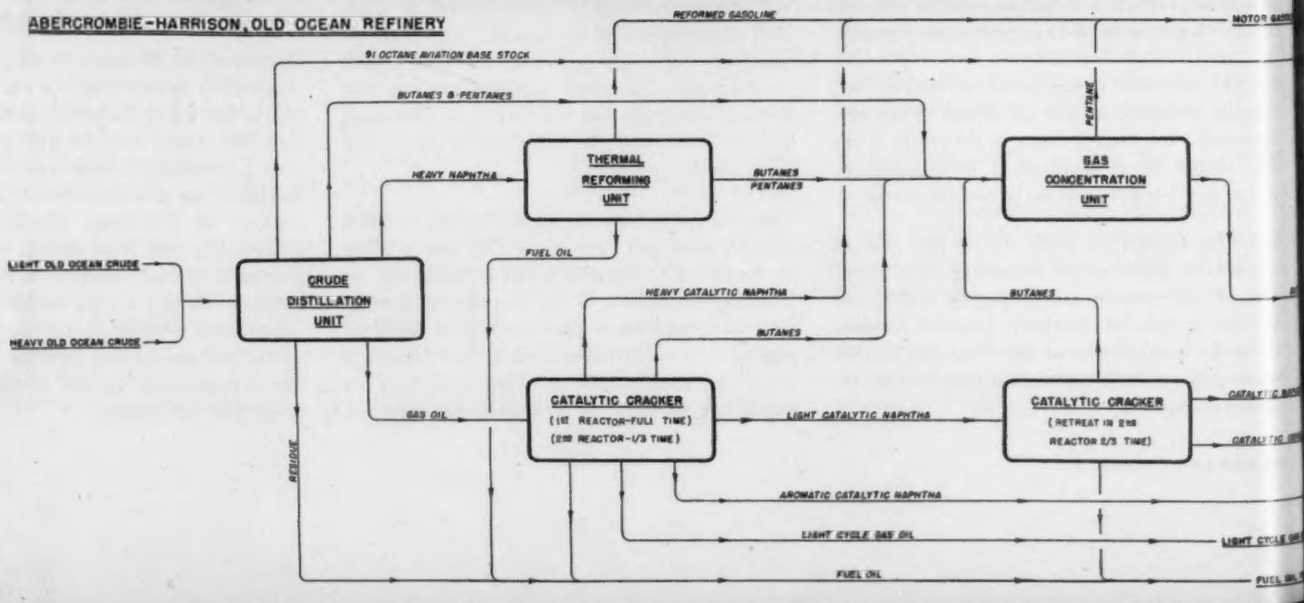
Congress too is showing an inclination to delve into the plans and purposes of PRC and it is one of the subjects scheduled for investigation by the Truman Committee. If the government is to go into the oil business in other parts of the world on any kind of an extensive scale it will require a heavy investment and Congress will have to supply the funds or at least authorize their expenditure. Its mood toward the launching of costly undertakings by the executive branch of the government under the guise of war necessity is becoming increasingly critical. Some members already have raised questions as to the legality of Secretary Jones's action in organizing Petroleum Reserves Corporation and Senator Moore has introduced a resolution calling for its dissolution in which he said he was acting also for Senator Brewster of Maine. The trend of feeling among the legislators appears to be against government invasion of the fields hitherto reserved for private enterprise beyond the extent imperatively required by the war. As a consequence of this feeling, in addition to the opposition raised in other quarters, it would not be surprising if PRC were to be dissolved or allowed to fade quietly out of the picture.

In spite of the repeated statements by Secretary Ickes that the Petroleum Administration for War will go out of business as soon as the emergency ends there is a lingering suspicion in many minds that he would like to see a strong government agency set up to engage in certain phases of oil activity at home and abroad. There have been repeated rumors that he favors a government controlled company to produce oil from the national reserves for the needs of the Army and Navy.

These rumors the Petroleum Administrator has denied and he has pointed out the large number of permits issued to individual oil operators to drill on public lands and the liberalization of the terms governing such leases. The Secretary's position is that he is concerned as to the nation's oil supply to meet future emergencies that may arise and wants to be sure that its interests are safeguarded in this respect. He has frequently made the statement of late that we shall be able to find the oil necessary to carry on to victory in the present struggle but that we could not possibly provide the products required to fight another war as the situation stands at present and that this problem needs careful and immediate consideration. This thought is back of the proposal to accumulate large reserve stocks in storage for emergency government use or to require repayment in kind of oil supplied on lend-lease. The fact that the Secretary has frankly put his thoughts and apprehensions before the representatives of the oil industry and asked for their assistance and advice is accepted as an indication that he is more interested in results than in methods.

Results of the discussion of oil policy to date are regarded by oil men who have expressed themselves on the subject as distinctly encouraging. The debate that started over the question of the government's assuming commitments in relation to foreign oil has now broadened to include the whole problem of developing adequate supplies both domestically and from outside sources. The appointment of the Committee on National Oil Policy paves the way for the industry to give its best constructive thought to the many questions involved and assures that its voice will be heard in the determination of the future course to be adopted by the country.

Left: Fluid Ca.alyti Cracking Unit wit Fractionating T wer on Left.



LARGEST DPC HIGH OCTANE PLANT NOW READY FOR OPERATION

By H. M. Nelly, Jr.* and Stanley Gill**

Plancor 880 at Sweeny, Texas, Will Utilize Crude and Gas from Old Ocean Field in Two-Stage Fluid Catalytic Cracking Unit—High Conversion Rate Attained.

ADJACENT to the Old Ocean oil field near Sweeny, Texas, construction work on a $23,000,000 aviation gasoline refinery is nearing completion. Part of the project was put into operation last October, about fifteen months after bulldozers started clearing underbrush and trees from the plant site and the initial water well was being drilled to supply water for construction.

The project is the Defense Plant Corporation's Plancor 880 being engineered and constructed for their agents the J. S. Abercrombie Company and the Harrison Oil Company by the J. F. Pritchard Company. Four of the six refining units with the exception of the crude distillation unit are licensed by the Universal Oil Products Company.

When complete the refinery will be the largest 100-octane aviation gasoline plant being built by the Defense Plant Corporation. Approximately 450 acres were used for the project. When completed it will be the most modern aviation gasoline refinery in operation in this country. During the last few months of construction about 1700 men were employed by the engineer-contractor.

The J. S. Abercrombie Company and the Harrison Oil Company will operate the refinery on a non-profit basis and will deliver to the government in February 100-octane gasoline meeting all U. S. Army Grade 130 specifications at a total estimated cost of about nine cents per gallon.

The refinery has six processing units.

First, a crude distillation unit consisting of a crude flash tower, a virgin gasoline depentanizer, an atmospheric topping tower, and a vacuum tower. From the virgin gasoline depentanizer will be produced an under-cut 91-octane aviation gasoline which will be used in the final 100-octane gasoline blend. The atmospheric tower will produce overhead a heavy naphtha charge for the thermal reforming unit and as a side cut light gas oil for charge to the catalytic cracking unit. Off the top of the vacuum tower will be taken a heavy gas oil cut which will also go to the catalytic cracking unit. The bottoms from the vacuum tower will be pumped to fuel oil.

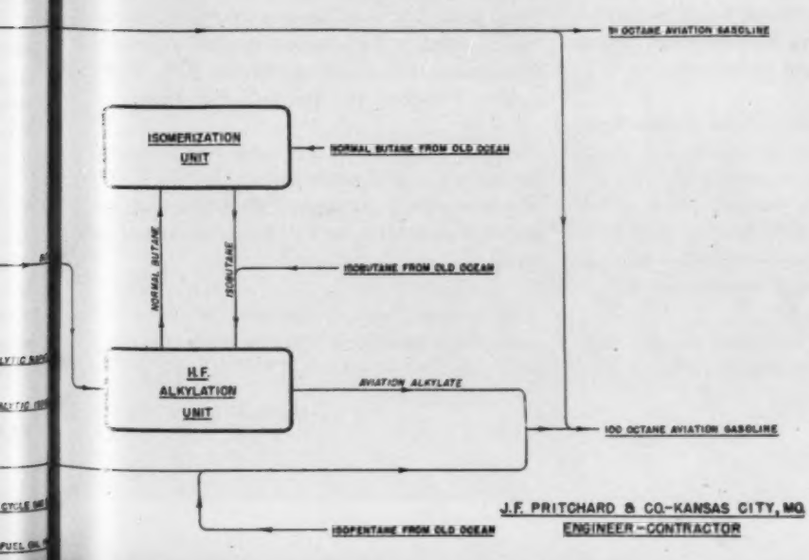
Second, a thermal reforming unit which will handle heavy naphtha from the crude unit to produce motor gasoline for sale, and butylenes for use in the alkylation unit. The transfer line of this unit will operate at low pressure and high temperature in order that a maximum amount of butylenes may be produced for the alkylation operation.

Third, a two stage "fluid" catalytic cracking unit to process the light and heavy gas oils from the crude unit. This unit is different from other "fluid" cracking plants that have been put into operation to date in that it has two separately operated reactors, connected to a common catalyst regenerator. The reactors are 21 feet and 16 feet in diameter and the regenerator 42 feet in diameter. The two reactors will be used in the operation. The first reactor will operate full time on a virgin gas oil from the crude unit. The second reactor will operate one-third on virgin gas oil and two-third's time re-treating light catalytic naphtha produced from the initial catalytic cracking operation. Products from the combination operation of this unit will be, besides catalytic base stock and catalytic isopentane, heavy naphtha which will go to motor gasoline, light cycle gas oil which will be sold as a distillate fuel, butylene and iso-butane which will be used in the alkylation operation, and heavy gas oil which will go into fuel oil.

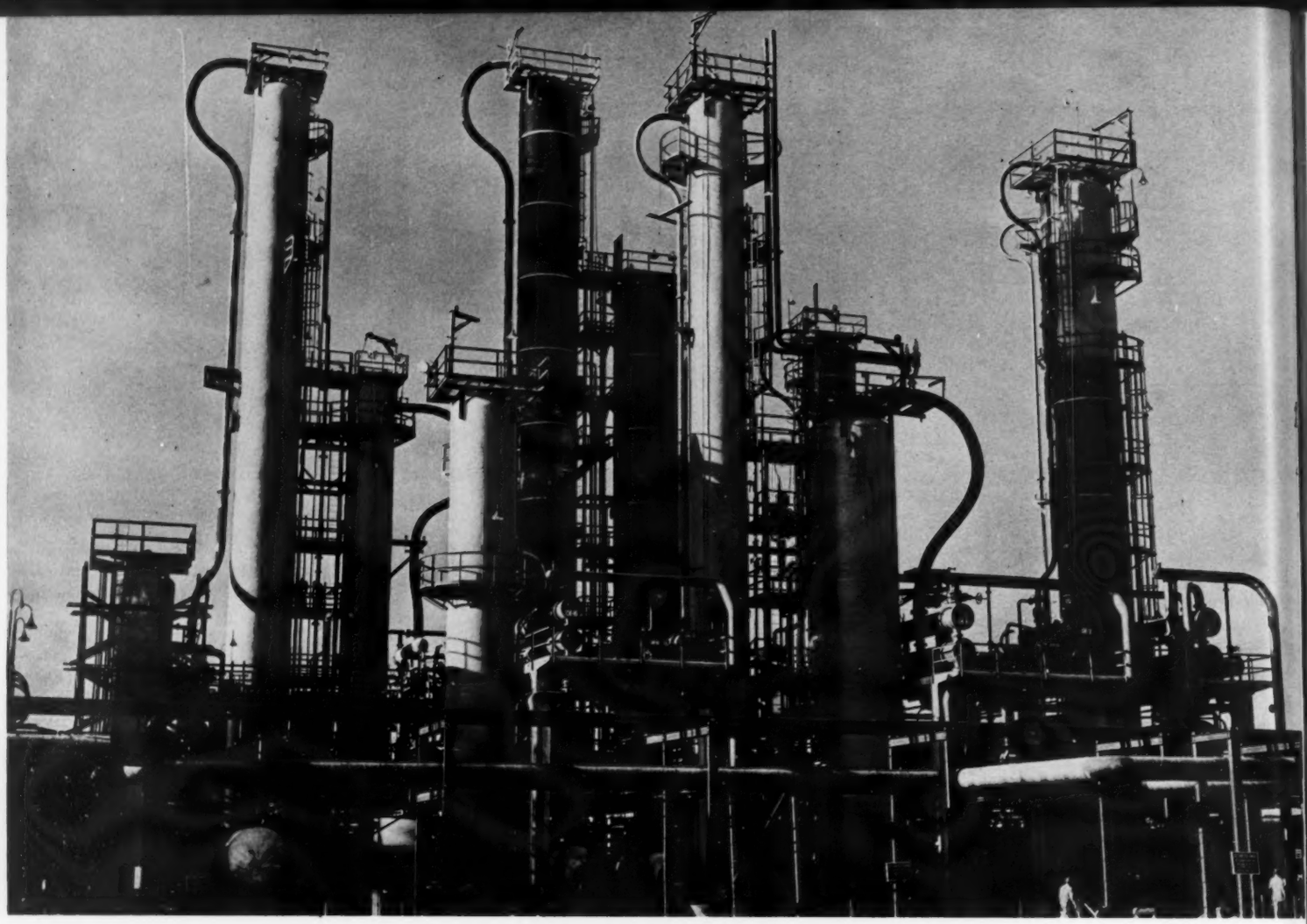
Fourth, a gas concentration unit which will stabilize and rerun the products from both the first and second stage reactors of the catalytic cracking units, and prepare from these an iso-butane-butylene feed for the alkylation unit.

Fifth, a hydrofluoric acid alkylation unit to alkylate isobutane with butylenes for the production of aviation alkylate. This unit has six Stratco contactors and is one of the two largest alkylation units of this type in operation. Provision has been made in the design of both this unit and the gas concentration unit to allow for a small amount of amylene alkylation.

Sixth, a butane isomerization unit to produce isobutane from normal butane for utilization in the alkylation unit. The normal butane charge for



*Manager of Petroleum Division, J. F. Pritchard & Co., Houston, Texas.
**General Manager Refinery Division, J. S. Abercrombie & Co., Houston, Texas.



Gas Concentration Unit; Center Tower is 125 Feet High

this operation will come primarily from the high pressure recovery plant in operation at the Old Ocean field and to a lesser extent from some of the other refining units.

Besides these six refining units, equipment has been provided for caustic washing the cracked gasoline and acid treating part of the aviation gasoline base stock. Treating problems were greatly simplified since crude from the Old Ocean field is "sweet." This also resulted in eliminating all alloy steels in the construction and because corrosion allowances could be done away with in some cases and in others cut down, an appreciable amount of steel was saved.

Since there were no facilities at the plant site prior to the starting of the project, it has been necessary to provide all of the utilities required for the operation of the above refining units.

The equipment supplied for this purpose includes a 62,000 GPM Pritchard induced draft water cooling tower; three 250,000 pound per hour Riley boilers generating steam at 450 pounds/sq. in., and 100° F. superheat; a 1500 kilowatt gas engine driven electric power station; and an Infilco water treating plant. Fuel for the entire project is gas supplied from the Old Ocean oil field. All drivers operate on steam except the fans in the water cooling tower which are motor driven.

Operating tankage has been provided adjacent to the plant site and tank farms for storage of products and crude furnished at Sweeny and Freeport, Texas. Due to wartime shortages in steel the tankage facilities were kept at an absolute minimum.

For shipment of products, loading facilities have been provided as follows: a forty spot railroad tank car loading rack which is equipped to load all products; a tanker terminal at Freeport, Texas, with facilities to handle 120,000 barrel tankers; a barge terminal on the San Bernard River; and a truck loading rack adjacent to the refinery.

To provide living quarters for the personnel required for the operation of the refinery, 223 apartments and 15 duplex houses were built. In addition to this a community building and a school house were provided. This housing project is adjacent to the plant site and was handled through the Federal Public Housing Administration.

To operate the refinery approximately 400 men and women have been employed. Although this operating force was built up entirely during a period when operating personnel were in great demand, it was possible to accumulate personnel for the actual operation of the refining units and the utilities having an average of twelve years experience.

In setting up the process design, full advantage was taken of the high gravity crude produced from the Old Ocean field. This field flows a 36-38 gravity crude oil from the outlying part of the structure and a 48-50 gravity light oil from the central part of the structure. The light oil is produced with an appreciable amount of gas which is processed through a high pressure absorption system and returned to the structure through a pressure maintenance plant operated by the J. S. Abercrombie Company and Magnolia Petroleum.

From the high pressure absorption system normal butane and isobutane are supplied for the operation of the isomerization and alkylation units together with iso-pentane for the aviation gasoline blend.

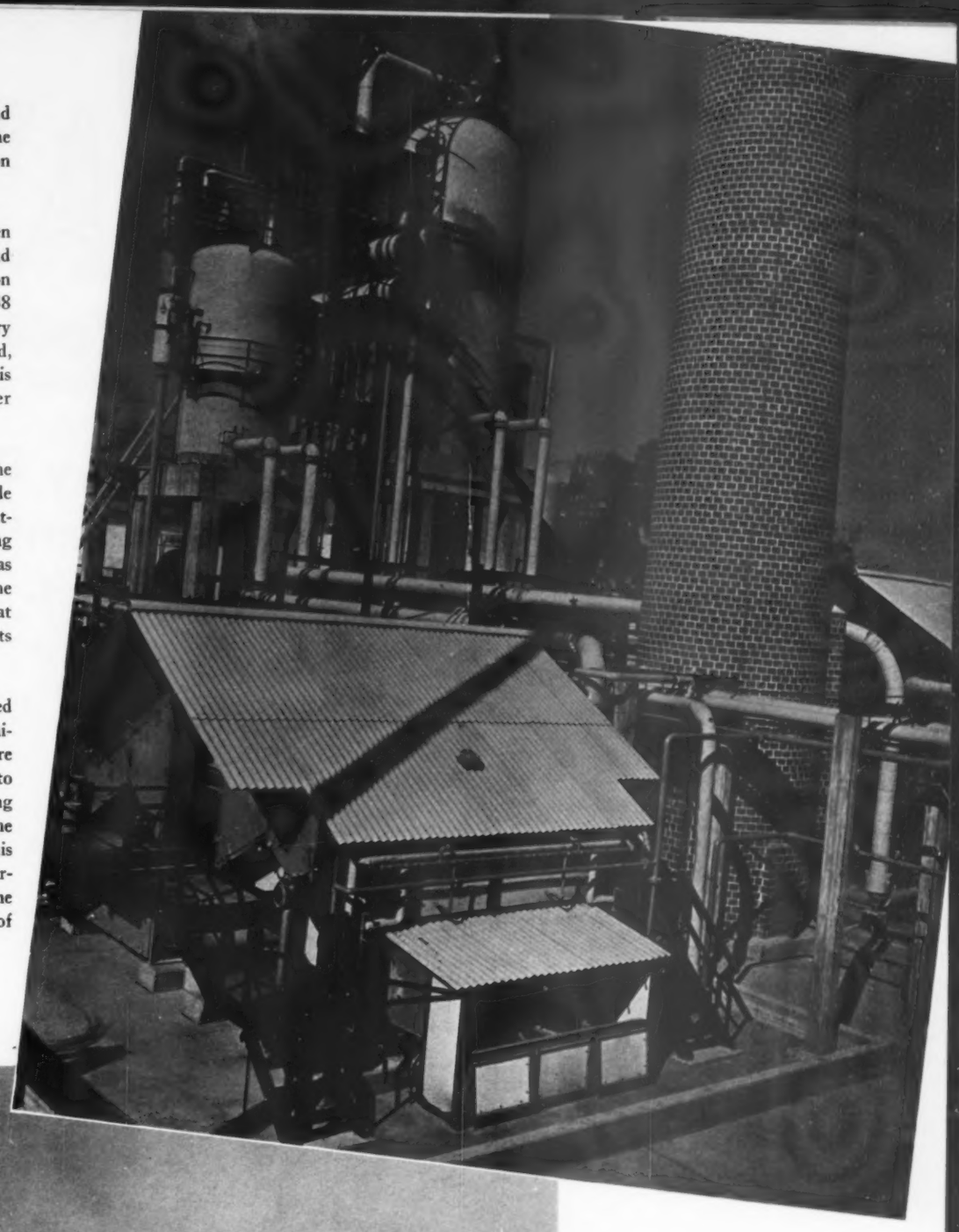
The estimated cost of operation per barrel of product is lower than is normally realized in similar refining operations.

This is due to the stream-lining of the refinery and also to the fact that the project is located at the crude source, thus eliminating transportation costs on this item.

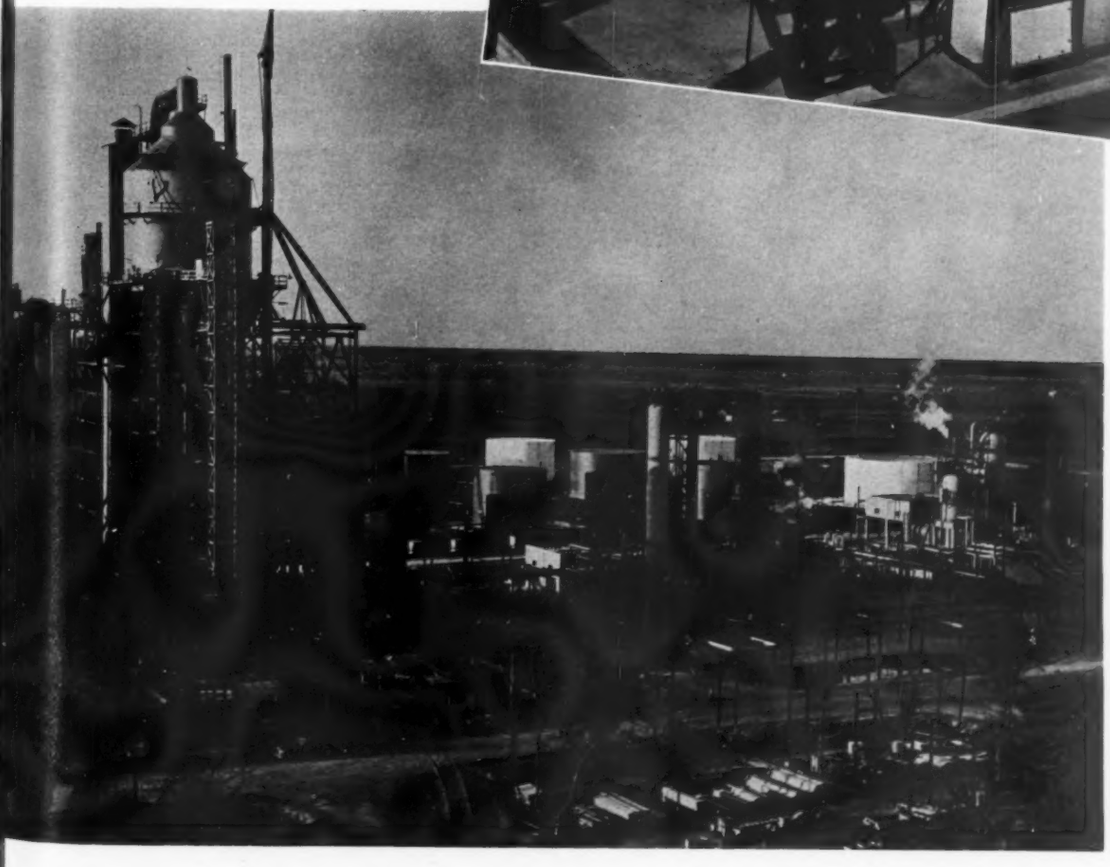
Because a great deal of consideration was given to correlating the production from the field and the high pressure recovery unit with the operation of the refinery it is possible to convert about 38 per cent of the crude oil charged to the refinery into 100-octane gasoline which will, when leaded, meet U. S. Army Grade 130 specifications. This is higher conversion than is realized in other refineries.

Basically, the process design was made with the view in mind to produce from Old Ocean crude the maximum amount of 100-octane gasoline meeting all "rich mixture" specifications while using the minimum amount of equipment. Care has been taken, however, to make sure that during the post-war period the equipment would be such that the refinery could be operated to produce products for a competitive civilian market.

During the past two to three years the so-called "distillate" or light oil fields have come into prominence and along with them cycling and pressure maintenance plants. This project is the first to coordinate these new field operations with existing refinery processes, taking full advantage of the characteristics of the light oils. The results of this coordination are reflected in the increased conversion of the crude oil charge into aviation gasoline and motor gasoline, and in the lower cost of operation of the entire refinery.



Above: Crude Distillation Unit; Vacuum Furnace in Foreground; Atmospheric Tower in Rear.



Left: General View of Plant; Reforming Unit in Center, Cat Cracker at Left.

A PRITCHARD FIRST

High Conversion Through Co

38% of the Light and Heavy Crude Oils are Converted to 100 Octane Gasoline in this PRITCHARD Project. . . . .

GAS CONCENTRATION UNIT stabilizes and reruns the products from the Catalytic Cracking and Reforming Units and prepares B-B feed for the Alkylation unit.

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ERCROMBIE-HARRISON REFINERY ST TO COORDINATE HIGH PRESSURE COVERY AND PRESSURE MAINTENANCE ITH REFINERY PROCESSES . . . .

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EFFICIENT refinery operation depends upon the intelligent adaptation and coordination of the various oil field recovery processes with the proposed or available refinery processes. This was the guiding factor in the engineering and design of the new Abercrombie-Harrison 100 Octane Refinery, by the J. F. Pritchard and Company, petroleum division.

Basically the process is designed to produce the maximum amount of 100 Octane Gasoline from the light and heavy oil production of the Old Ocean Field. Coordination of the world's largest High Pressure Recovery unit and Pressure Maintenance Plant with the refinery processes has made possible a 38% conversion. This is considerably higher than realized in other refineries.

Heavy and light oil production and butane recovery have been so set in the pressure maintenance plant to allow the refining processes to operate with maximum efficiency and flexibility. Definite care was taken in the basic planning and engineering to make sure the refinery would produce products for a competitive civilian market in the post-war period.

This $23,000,000 aviation gasoline refinery heads an impressive list of Pritchard engineered petroleum projects now nearing completion. J. F. PRITCHARD AND COMPANY, *Petroleum Division*, Fidelity Building, Kansas City, Missouri, and Gulf Building, Houston, Texas.

CRUDE DISTILLATION UNIT, Atmospheric Tower, Vacuum Tower and Vacuum Furnace.

All of the refining units in the Abercrombie-Harrison Refinery, excepting the crude distillation unit, are licensed by the Universal Oil Products Company.

KANSAS CITY
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ENGINEERS AND CONSTRUCTORS
FOR THE CHEMICAL • PETROLEUM • GAS AND POWER INDUSTRIES
Manufacturers of Mechanical and Atmospheric Cooling Towers

"BLITZ RIGS" SWELL SUPPLIES FOR THE OIL FRONT

Use of Portable Equipment Establishes Remarkable Records for Speed in Development of California's Shallow Fields

MANY a not too grizzled veteran of the oil business recalls the time when a 2,000 foot well was a deep well, and six months was not considered over-long for its completion. But the early days of the twentieth century changed all that. The rotary drill was invented and the boom of cable tools was replaced in most parts of the country by the grinding of the rotary bit into the depths of the earth.

With the development and perfection of the rotary drill, the day of the deep well arrived. In California's Kettleman Hills and other deep well areas, drills went further and further into the recesses where nature had trapped the fluid black gold. Wells were sunk to depths of 13,000, even 15,000 feet. Continental Kern in California was drilled to a point further below the surface than the top of Mt. Shasta is above sea-level.

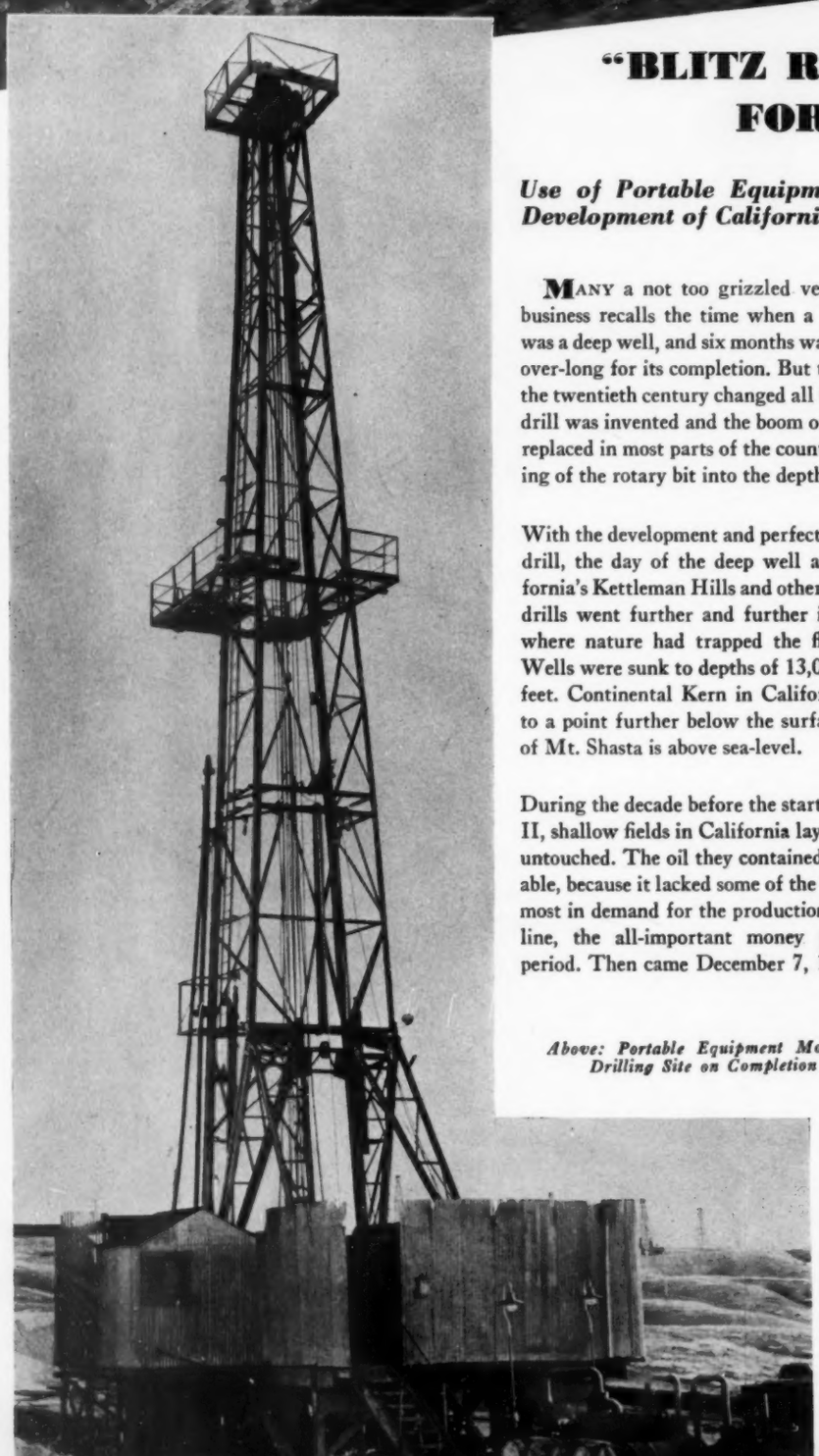
During the decade before the start of World War II, shallow fields in California lay idle and almost untouched. The oil they contained was less profitable, because it lacked some of the lighter elements most in demand for the production of motor gasoline, the all-important money product of the period. Then came December 7, 1941, and heavy crude became premium material because it was both high in fuel value and suitable for the manufacture of 100-octane and other high octane aviation gasoline. A veritable treasure house lay relatively dormant as to further development in this type California field.

Early in the war Standard of California realized the value of these shallow fields in this emergency situation. At once the company started reopening old fields in the Coalinga, Poso Creek, Kern River Front and Taft areas of the state's northern district, and began developing new areas in old fields in the Montebello and Huntington Beach districts to the southward. Early in 1943 President H. D. Collier pledged that the company would drill over 300 wells, or a well a day, during the remainder of the war, in order to help meet the war's accelerated demand for more oil to power and weapon the nation's fighting forces. That promise was kept by the company's producing department through the use of portable equipment for drilling wells up to around 4,000 feet in depth.

An old-time prospector would rub his eyes if he could see a caravan of trucks winding through areas loaded with one of these "blitz rigs," as drillers call the portable outfits. On one truck he might see a portable derrick lying on its side, with blocks already in place and rotary hose attached. On another truck and trailer the derrick's base might be carried in one piece, ready to place in position as soon as the caravan reached its destination.

Standard of California is using two types of "blitz rigs" in its accelerated program to produce more

Above: Portable Equipment Moving to New Drilling Site on Completion of Well.



Ninety-four Foot Cantilever Mast Assembled and in Position.

Upper Left: A foundation is Lifted to Clear the Well-head.
Above: Telescopic Mast Derrick at Full Height.

Portable Draw-works are Being Lowered to the Ground.

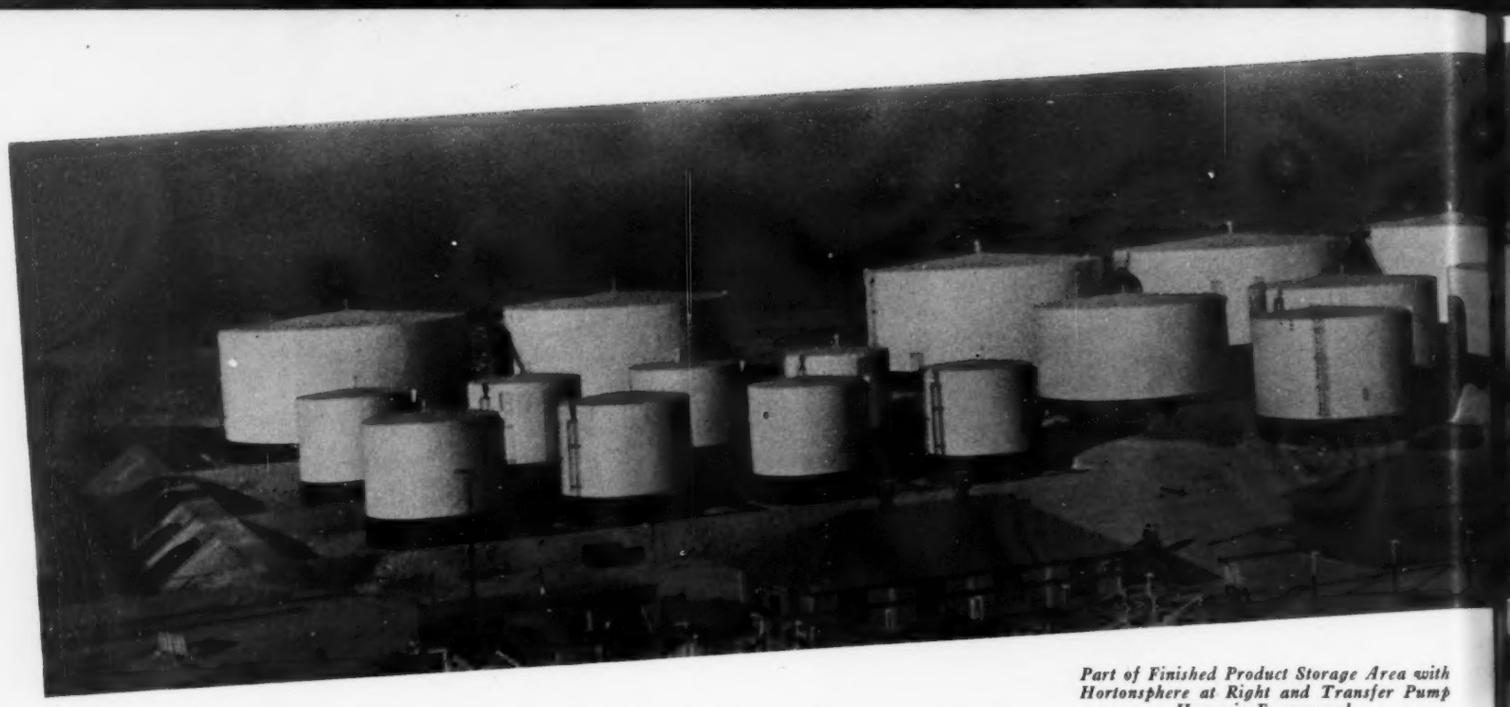
and more oil for the United Nations. One of these is the telescopic type of derrick which is completely portable; the other utilizes a hinged type derrick which is carried in two sections, assembled into one piece at the site of the well, and raised into place by the rig's own drawworks. Four rigs employing the telescopic type derrick have been in constant service. This type is completely portable. The mast derrick and its drawworks are carried on the same truck and trailer, with the whole weight not exceeding forty tons. Since this derrick does not require a foundation or a cellar, it can be set up in as short a time as one day. The legs stand on a wooden mat as a rule; occasionally concrete is laid, but this is not necessary in most cases. The derrick is raised by hydraulic jacks, and the telescope section by a hoisting line operated by a small engine carried on the trailer frame. This engine also operates the pump for the hydraulic jacks. Extended to full height the mast is usually about 94 feet tall. These rigs are powered with a gas engine of 150 H.P. to operate the drawworks and rotary. The mud pump is operated by an independent engine mounted on a base with the pump. A pit for the mud suction is dug close to the rig. A short pipe leads the mud from the overflow to a mud screen set over the pit. The working platform for the drilling crew is carried in sections, and is about twelve by twelve feet.

Seven portable rigs that are moved in sections are also in use on Standard of California wells. A five foot high portable steel base is used for this derrick and rig, and the rotary table is set upon this same base. With this type of mast derrick equipment, two engines of 150 horsepower are required to operate the mud pumps, rotary table and drawworks. These engines are so connected that they can operate separately or as one unit when increased power is required for a single operation. On these rigs a rectangular steel tank is set for the mud suction and a short pipe carries the mud from the well to the mud screen set over the tank.

On completion of the wells, which usually run up to depths of 4,000 feet, a floor type pumping unit is used. This requires a concrete foundation which is constructed in advance of rigging up and drilling, thus expediting the work and making for efficient use of manpower and time.

One of the principal virtues of the portable equipment is that time and material is saved in preparing locations, rigging up and tearing out, for as little as 24 hours is required after the completion of one well, to move, rig up and start drilling operations at a new location, with the telescoping type of mast, and the same may be accomplished with the assembled type of mast in 48 hours. On the average it takes from one to three days to dismantle, move and reassemble one of these portable rigs, depending somewhat upon the distance from one location to another. This compares with eight to ten days normally required to move in and rig up a conventional type derrick. This time saving is important when the demand for oil and more oil is as urgent as it now is under war conditions. The time saving also cuts the cost of drilling.

So far the portable rigs have been used only for so-called shallow wells, but Standard engineers believe their full possibilities have not been realized.



Part of Finished Product Storage Area with Hortonsphere at Right and Transfer Pump House in Foreground.

FRONTIER'S NEW 100-OCTANE PLANT READY TO GO INTO ACTION

Notable Addition to Refining Facilities of Rocky Mountain Area Will Convert Wyoming Crude to Aviation Fuel.

PRODUCTION of "fighting gasoline" for Allied air forces is expected to get under way early in 1944 at The Frontier Refining Company's 100-octane gasoline plant now practically completed at Cheyenne, Wyoming. Financed by Defense Plant Corporation, authorized cost of the new plant was $6,472,000 at last report. A crew of more than eight hundred workers was employed on the job as of December 15, with construction paced to meet a February 15th completion date.

A little more than a year ago the Frontier Refining Company had a crude capacity of 1,600 barrels a day, and a Dubbs cracking unit with a rated capacity of 750 barrels a day. Immediately after Pearl Harbor its president, M. H. Robineau, in co-operation with the Universal Oil Products Company, worked out plans, which were subsequently approved by the Petroleum Administration for War, for the installation of processes employing new and effective methods and techniques to convert products from Rocky Mountain crude into 100-octane aviation gasoline. These new facilities, which more than double the crude capacity of the existing refinery, include the following UOP units: fluid-flow catalytic cracking, hydrogen fluoride alkylation, butane isomerization, and thermal reforming. The new equipment also includes a gas concentration unit of Universal design.

Frontier got its authority to build the plant in May, 1942, from DPC. The contract for construction was let to the Fluor Corporation and ground was broken on September 28th of that year, with Senator Joseph O'Mahoney (Wyo.) wielding the shovel. Since then construction has proceeded as rapidly as materials could be made available.

In the Frontier plant a combination of thermal and catalytic processes is carefully balanced to produce all of these vital constituents of aviation gasoline in the optimum proportions for use in the finished blended product. The heart of the operation is the catalytic cracking unit. This produces isopentane, which is a high octane base stock for aviation gasoline, and a considerable quantity of isobutane and olefins, which are raw materials for the production of alkylate. Additional olefins and butanes for alkylation are produced in the Dubbs thermal cracking and thermal reforming units. Alkylate is produced in the UOP alkylation unit by combining olefins and isobutane, with hydrogen fluoride as the catalyst.

In order to supplement the isobutane available from the above operations and to make full use of the olefins to produce the maximum yield of alkylate, the UOP butane isomerization unit converts available normal butane into isobutane.

The new plant, which dwarfs the present Frontier operating units, provides Wyoming with one of its largest industries. It is strategically located within close proximity to the Rocky Mountain area producing fields. Rising impressively on the Wyoming prairie south of Cheyenne, the plant has 117 towers, compared to six in the original refinery; uses more than fifty miles of steel pipe; its huge catalytic structure is as tall as a 12-story building and its loading rack will accommodate sixteen tank cars and fourteen tank trucks.

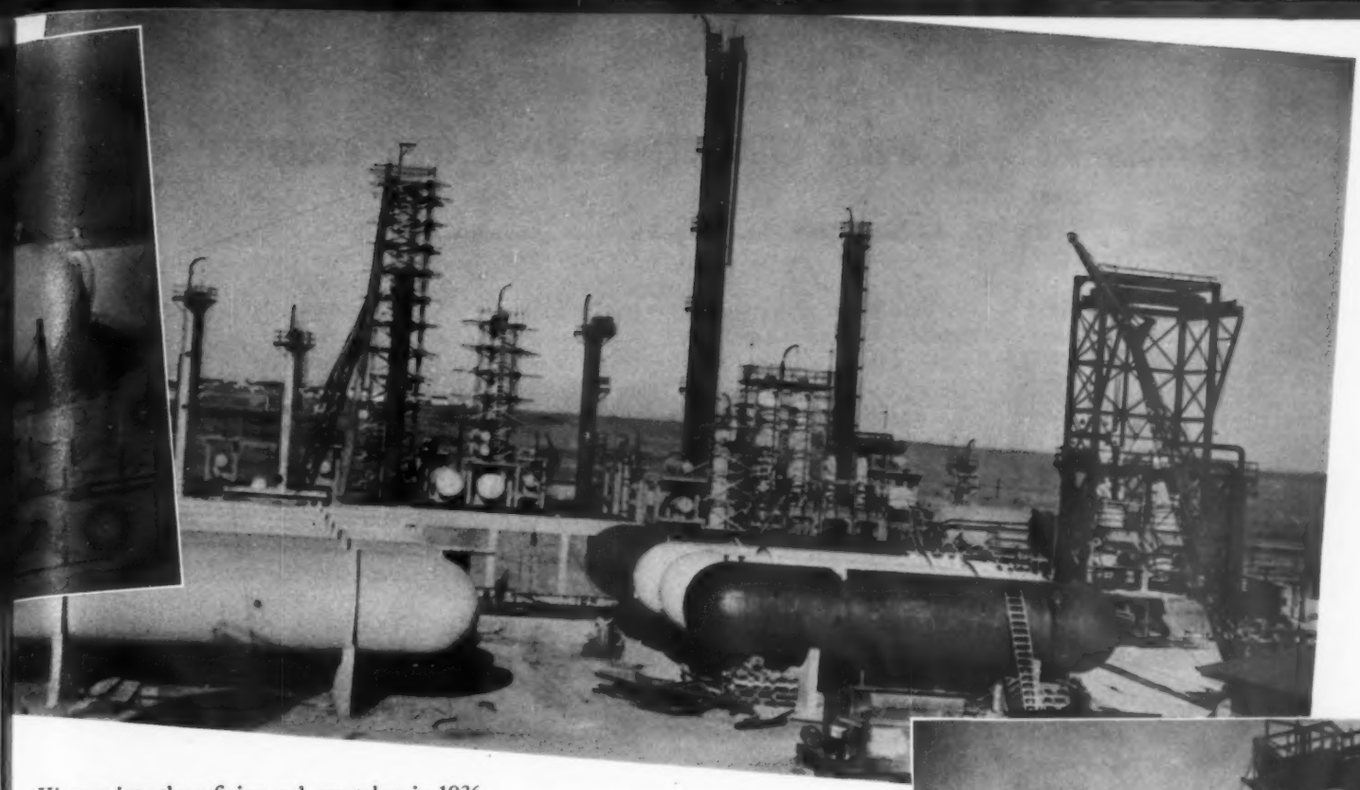
"When the history of America's home front war effort is written, we shall have reason to feel eminently proud of the men who are building this vitally important refinery," said M. H. Robineau, Frontier president. "They have been splendid home front soldiers, doing a magnificent job to help win the war in the shortest possible time."

Actual production of "starting stock" to get the new plant through its initial operational stages has already been launched at the present Frontier refinery, where a new unit was added for this purpose. Plans have been carefully charted to assure immediate production from the 100-octane units as soon as the plant is completed.

Of incidental importance in the strategic location of the plant is the fact that raw materials, other than crude, will be hauled to the refinery by tank truck so as to free tank cars for other necessary long haul service. Crude is delivered by the Rocky Mountain Pipe Line Company.

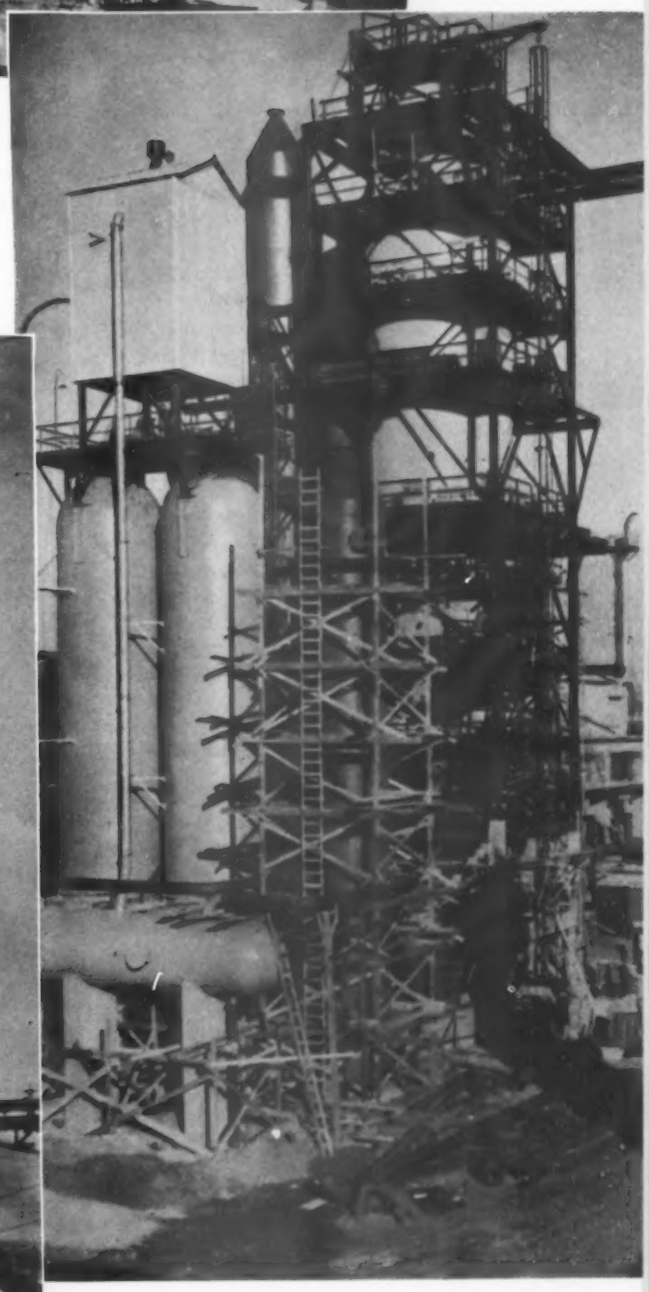
Storage capacity at the new plant will be twelve million gallons. Other facilities will provide for the processing of raw materials from neighboring plants.

Mr. Robineau has behind him a long record of experience in the oil business, which he entered on the marketing side. Born in Syracuse, N. Y. he paid his way through the Colorado School of Mines by conducting his own orchestra in Denver hotels. He was graduated in 1923 with the degrees of Mechanical Engineer and Mining Engineer. On leaving school, Mr. Robineau went to work for the Texas Company as district manager in Western Nebraska, with headquarters at Sidney. In 1925 he entered the jobbing business for himself and soon had flourishing stations all over Nebraska.

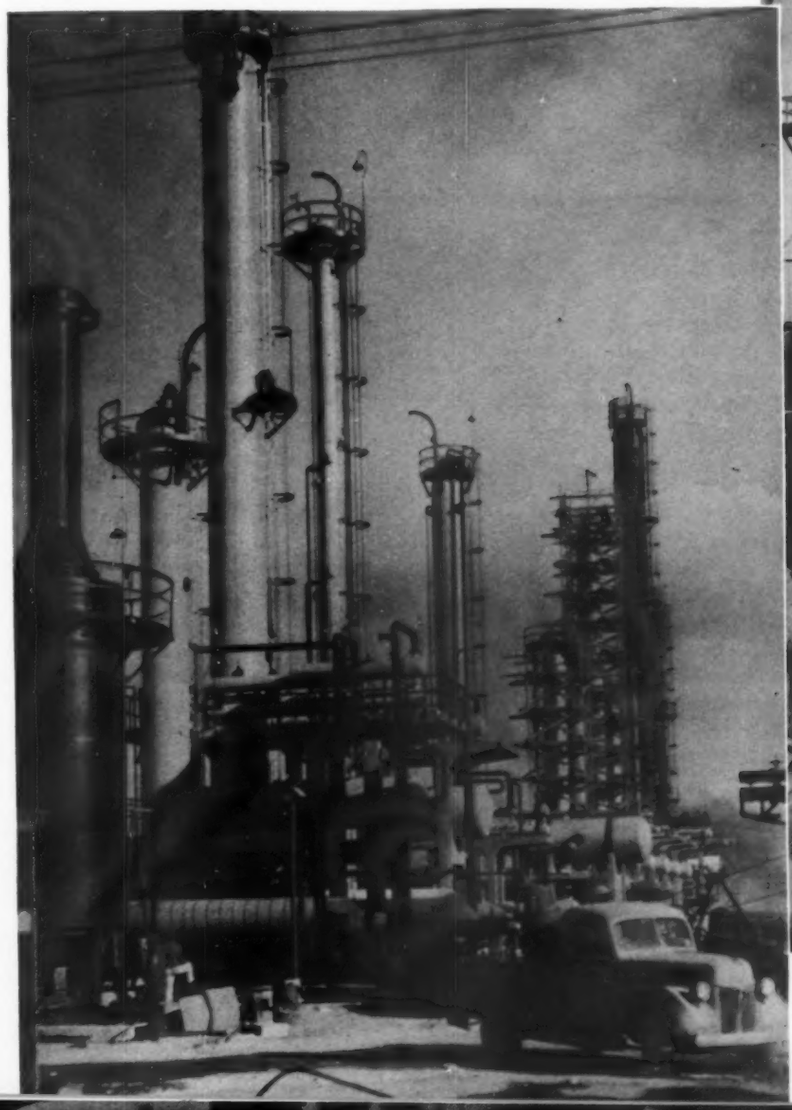


His step into the refining end was taken in 1936 when he leased a skimming plant at Cheyenne, Wyoming. Later, he became connected with the Bay Petroleum Company and took complete charge of building that company's refinery in Denver. He was president of the Bay Company when he resigned in 1938 to establish the Frontier Refining Company.

Above: Alkylation and Isomerization Fractionating Section and Gas Storage Units.



Below: Fractionation Sections, Gas Concentration and H F Alkylation Units.



Catalytic Cracking Unit—Storage Hoppers in Foreground—Reactor Column at Left of Structure.

★ ★ ECHOES FROM THE WASHINGTON OIL FRONT ★ ★

By **W. J. Maddox,** Chief of World Petroleum's Washington Bureau

President on Post War Oil

The President

PRESIDENT Roosevelt had something to say about petroleum in his 13th report to Congress on lend-lease, mostly on war demands. He did, however, take a brief view of the post-war oil situation, and it may be significant that he made no mention of Petroleum Reserves Corporation or its place in the picture. This has led to speculation as to whether he may be backing away from PRC and instead thinking along the lines of an international oil compact. A paragraph referring to oil is as follows:

"After the war the nations of the world, including the United States, will require petroleum to maintain their industrialized economies. Discoveries of new oil fields will undoubtedly be made to supplement known oil reserves and, as in the past, the steady development of technological improvements in oil production will make it possible to draw on oil reserves which cannot now be tapped. Nevertheless, as in the case of other natural resources, some nations will have insufficient oil reserves to meet their petroleum requirements. Others will have a surplus. Agreed action by the nations of the world, as provided for in the master lend-lease agreements, for the expansion of production, the elimination of discriminatory treatment in commerce, and the reduction of trade barriers, will assure to the United States and other nations fair and equal access to the petroleum produced in all parts of the world."

Foreign Refinery Expansion

As for the war requirements from here on out, the President dampens any hope of easing the strain on our domestic production. He says:

"Every effort is being made to increase the crude oil production, the refining capacity, and the supply of tankers available to the United Nations. The over-all petroleum war needs of the United Nations in 1944 will rise above what they are now as the magnitude of our offensive increases. The increasing number of planes, ships, and tanks which we are now producing and putting into action against the enemy require increasing quantities of gasoline, oil, and lubricants.

"Additional supplies of petroleum products from other areas will not, therefore, result in reducing the demands on our own petroleum resources. All available supplies of petroleum products will be required for a speedy and complete victory of the United Nations over the enemy. In the future, as in the past, the petroleum resources of each of the United Nations will be utilized in its own direct war effort and the combined war effort, in proportion to the maximum ability of each to produce and efficiently deliver the petroleum products needed in the prosecution of the war."

Mr. Roosevelt does not mention criticism of British contributions to war demands for oil. He answers them, however, by saying that all refining facilities in the Middle East, as elsewhere, are being used to the fullest extent "consistent with the efficient use of tankers and the maximum output of those petroleum products that are most needed for fighting the war, such as aviation and other high octane gasoline." The refinery at Abadan, he says, is operating at its "top output under these conditions." The capacity of the British-owned refinery at Haifa is being expanded and the refinery at Suez has been operated at full capacity throughout the period of warfare in that area. All this is paid for by the British. He adds that a project has been undertaken to expand the output of war products of the Bahrein refinery, halfway down the Persian Gulf. The refinery is owned by American capital and the equipment for expansion is being supplied from the United States and paid for by the company, assisted by a loan from Defense Supplies Corporation.

Rayner Named Oil Advisor

Charles B. Rayner

CHARLES B. Rayner has been designated Acting Petroleum Advisor to the Secretary of State. He was formerly petroleum advisor to the Foreign Economics Administration.

Graduated from Amherst in 1909, with a B.A. degree, Mr. Rayner was in the employ of various oil companies from 1907 to 1918. He served with the U. S. Army from 1918 to 1919. Subsequently he engaged in business for himself and became an independent oil operator on a modest scale. In 1941 he became regional director, Surplus Marketing Administration, U. S. Department of Agriculture. He joined the Board of Economic Warfare in September 1942. In this position he had the opportunity to become familiar with oil production and oil requirements in other countries in addition to his knowledge of the domestic industry. He is regarded as a man of sound judgment and a capable administrator. A factor in his selection for his present post probably was his freedom from affiliation with any oil company engaged in international operations.

Somervell Stands by Canol

Gen. Somervell

GEN. Brehon Somervell's castigation by the Truman committee for approving the Army's Canol project sets a new mark in "Monday-morning quarterbacking." The committee's report is the bitterest assailment yet made against any purely war project sponsored by military leaders. Undoubtedly more such criticism of military decisions will follow. Observers who recall the train of investigations after the first World War predict that those were not a patch compared with the "second guess" inquiries that will follow this one.

Somervell himself fell back on the Bible in his own defense. He quoted:
"And five of them were wise and five were foolish. They that were foolish took their lamps and took no oil with them; but the wise took oil in their vessels with their lamps."

Although condemning the Chief of Service Forces for his original decision, the report crossed up predictions by leaving completion of the project up to the Army. It had been indicated that the committee would recommend abandonment. Two members of the committee, Senators Connally (Democrat) of Texas and Hatch (Democrat) of New Mexico, issued a special statement disagreeing with the "severe criticism of the War Department."

According to Somervell, the Army has made a real strike in the Norman Wells field, far beyond its expectations. He told the Truman committee that proved reserves were 50 and probably 100 million barrels. Since then he has had information that would show even more. Prof. Lowell R. Laudon, head of the Kansas University geology department, has been quoted as saying the possibilities for oil development in the Canol area are "apparently limitless."

Laudon worked last summer for the Imperial Oil Company, which is handling the drilling end of the project for Army, and did exploratory work on Canol. He says: "We found oil reserves 100 times

as big as we first thought prevailed in the northern area." He predicted the project would pay for itself many times.

In the meantime, Somervell is going ahead renegotiating Army's contract with Imperial and the agreement with the Canadian government, both of which have been targets of criticism.

More Petroleum Attachès

REFLECTING increased activity in foreign oil are two items asked by the State Department and carried in the supplemental national defense appropriation bill for 1944 recently signed by the President. Provision is made for five petroleum attachés "to be assigned to various posts" and nine oil-control officers; two for Spain, five for Portugal and two for Portuguese colonies.

Checking back over the hearings of the House Appropriations Committee, behind closed doors, it appears that Monnett B. Davis, chief of the department's Foreign Service Administration, said "there is need for oil experts" in foreign countries. He explained that these are of two kinds; "control officers, who are assigned to certain areas in Europe which are being supplied American oil and where it is of very great importance to us to see what is done with it; and there are other experts who interest themselves in production."

Mr. Davis asked permission to "continue off the record." The State Department has maintained a tight lip on its foreign oil staff, but it has a number of oil attachés scattered about at strategic points to keep it supplied with information.

"Restore Competition"-Pew

J. Howard Pew

SUN Oil President J. Howard Pew sounded a note that is popular with the industry and one that is likely to be expressed more urgently from now on, when he said recently that with the transportation problem solved "the time has now arrived when it (the industry) should return to the healthy, intelligent competition that made petroleum one of the greatest industries in the world." He says this is the belief of the industry "even though rapidly increasing military needs continue to restrict petroleum supplies available for civilian use."

"This can be done," Pew declares, "when rationing is soundly administered. The industry, by and large, wants no relaxation of the anti-trust laws nor any immunity from either the spirit or intent of this legislation, either now or in the post-war period."

The pooling of efforts and facilities by units of the industry at the request of the government may have been necessary during the acute transportation emergency, he points out, but it is not in the best interest of the industry or the public.

Refiners, pressed for greater supplies of crude to keep pace with demands for war products, have been irked for some time at many of the government restrictions on production. For instance, they see no sense in spacing restrictions in old fields, where the gas pressure is gone and the question of drainage does not exist. Also, they fail to see the need of restrictions on the use of second-hand equipment, a lot of which is being junked because the operator can't drill any more wells.

No Easing of Restrictions

ESTIMATES of military demands for oil products are necessarily based on an assumption that the war will continue throughout the year but an earlier termination probably would not bring relief from present restrictions on civilian consumption. That is the conclusion reported by the Economics Committee of PIWC at the January meeting. The committee stressed the importance of keeping refinery output at the highest possible levels and of encouraging exploration and development activities in order to avoid indicated shortages and to bring depleted product stocks up to adequate working levels. Council Chairman W. R. Boyd, Jr., pointed out that after the end of hostilities there would be heavy demands for petroleum products for the rehabilitation of occupied countries.

More Production Needed

SURVEYING the world situation the Economics Committee expresses the view that "Due to more effective utilization of all United Nations sources and new high levels of domestic production, the situation appears comfortable during the first six months of this year but becomes increasingly serious toward the end of 1944 and emphasizes the necessity of increasing exploration, development and secondary recovery activities to increase domestic crude production.

"Increased production in this country, as compared with most other areas, would be particularly desirable in that it would: (1) Decrease the burden on both tankers and other forms of transportation in relieving the present necessity of having to take crude oil and products from more distant sources. (2) Make it possible to utilize idle refinery capacity in the Middle West for which the crude supply is quite inadequate. (3) Give a desired factor of safety in meeting military and civilian demand. (4) Avoid possible more severe rationing which might otherwise be necessary toward the end of this year."

Oil Shortage Far Distant

Dr. Per K. Frolich

EVEN when the oft-predicted shortage of natural petroleum comes we shall be able to slip into the use of oil from shale, natural gas, tar sands and coal without any violent adjustments, in the opinion of Dr. Per K. Frolich, director of the chemical division of the research laboratories of Jersey Standard.

But in the meantime, according to Dr. Frolich, "it would appear that in addition to the petroleum known to be present in the ground, large but as yet undiscovered reserves may be expected to exist in different parts of the world, including the United States. How long we can continue to locate this oil and bring it to the surface at the desired rate is an open question. At some future time, however, whether it be in the immediate future, in the next generation, or in a much later generation, a shortage in natural petroleum will occur.

"In the meantime, there is nothing to indicate that this should result in any sudden change as far as our supply and consumption of gasoline and other petroleum derivatives are concerned. Progress will continue in the petroleum industry's efforts to improve the efficiency of its processes and the quality of its products. Advances in engine construction will make for better efficiency in the utilization of fuels and lubricants. Increased drilling on a world-wide basis will bring in more oil. There will be necessary adjustments in supply and demand so that oil will be moved around freely from the principal centers of production to the principal centers of consumption. All this will tend to postpone the necessity—at least in time of peace—for turning to alternate sources of supply. Then, as the need arises, synthetic products from the sources indicated will gradually work their way into the picture."

•

No Workable Subsidy Plan

CRUDE price legislation having gotten as far as the Senate now appears to be something of an orphan. No aggressive sponsor has come forward to push the measure to final enactment. And oil men confess they are worried over their failure to find somebody to carry the ball for higher crude prices in the Senate.

Senator Elmer Thomas of Oklahoma appeared at one time to be the man. He has two crude price bills of his own pending, one lying on the table ready to be called up at any time under Senate rules, the other pigeonholed with the Banking and Currency Committee. These are in addition to the Disney bill which was passed by the House before

Continued on page 54

Foreign Oil Legion

Lloyd N. Hamilton

LLOYD N. HAMILTON, chairman of the board and director of Bahrein Petroleum Co. Ltd., has been elected a director of California Texas Oil Co. Ltd. Mr. Hamilton has been associated with Standard Oil Company of California since 1920, almost continuously in connection with the foreign activities of the company. During the 1920's his time was spent largely in Mexico and South America. From 1932 to 1940 he was active in the development of the company's Middle East concessions with headquarters in London. In 1941 he returned to the United States and took charge of Standard's Canadian operations.

Mr. Hamilton is now in New York making preparations for an extended trip abroad at the conclusion of which he expects to take up his residence in this city.

Roland E. Smith

AFTER completing over forty-five years of continuous service in the production branch of the oil industry, thirty-two of them with Magnolia Petroleum Company, M. J. McLaughlin retired from his position as vice-president and manager of production on January 1. Beginning as a field worker in Pennsylvania Mr. McLaughlin went out to Texas in 1912 as a district superintendent for Magnolia. He advanced to division superintendent and in 1919 became assistant manager of the company's production division and from that position succeeded to the post of production manager having been elected meanwhile to a place on the board and the position of vice-president.

E. D. Smith who has been assistant manager of production succeeds Mr. McLaughlin as manager, director and vice-president.

DR. OLIVER A. OHMANN, professor of psychology and head of the Department of Philosophy at Cleveland College, has been appointed assistant to A. A. Stambaugh, vice-president in charge of general sales of The Standard Oil Company of Ohio. Dr. Ohmann, who has been associate director of the Personnel Research Institute at the college, will head up personnel and personnel research for the sales department, serving on a part time basis until the end of the college year.

H. STEWART MERRIMAN has been made manager of the lubricating department of Socony-Vacuum Oil Company, Inc., according to a recent announcement from Walter L. Faust, Socony-Vacuum vice-president. Mr. Merriman succeeds William H. Correa who has been named director of the Washington, D. C. office of the company. Mr. Merriman joined Socony-Vacuum in 1921. He rose to the post of Lakes Division Manager with headquarters in Buffalo, New York and was moved, in 1942, to New York City to serve as assistant general manager of the lubricating department.

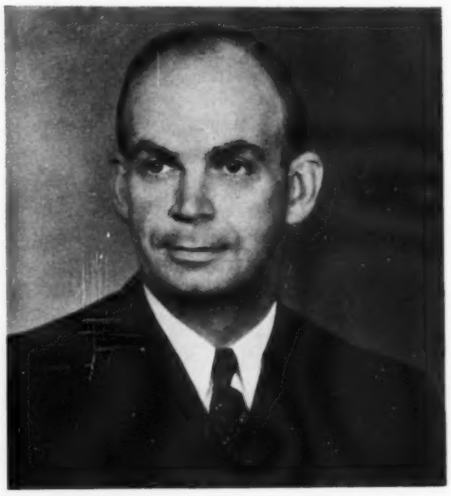
AT a meeting of the Los Angeles chapter of Nomads, held on January 12, Roland E. Smith, of Grant Oil Tools, was elected president for the coming year. Other officers elected were as follows: Wallace A. Sawdon, vice-president; J. C. Ballagh, secretary; Elmer R. Smith, treasurer; William McGraw, sergeant-at-arms; Prof. John F. Dodge, assistant secretary; Fred Tyler, assistant treasurer; T. M. Johnston, deputy sergeant-at-arms. Wilbur F. Bettis and Henry Pullman, the retiring president, were named as regents. The new officers will be introduced at the inaugural ball to be held in February and will assume their respective duties at the monthly meeting in March.

W. J. Campbell

W. J. CAMPBELL of Petroleum Machinery Corporation was elected president of the New York chapter of Nomads for 1944 at the annual meeting on January 10th. Other officers are G. B. Flanigan, vice president; H. B. Book, secretary; W. D. Robinson, treasurer; W. G. Foster, sergeant-at-arms; A. L. Woracek, assistant secretary; C. R. Tunnell, assistant treasurer; H. E. Maland, assistant sergeant-at-arms. F. J. Olson, retiring president, and Fred L. Convers were named as regents.

SAMUEL F. PRATT, general secretary of the Pennsylvania Grade Crude Oil Association, who tendered his resignation effective January 1, 1944, has joined the Union Trading Company, Inc., of New York City, as vice-president. Mr. Pratt has been connected with the Association in various capacities since November, 1932, including three years in Europe as manager of overseas operations. The Union Trading Company, his new connection, is headed by Joseph Schneider and is engaged in the domestic and export marketing of petroleum products.

Samuel F. Pratt



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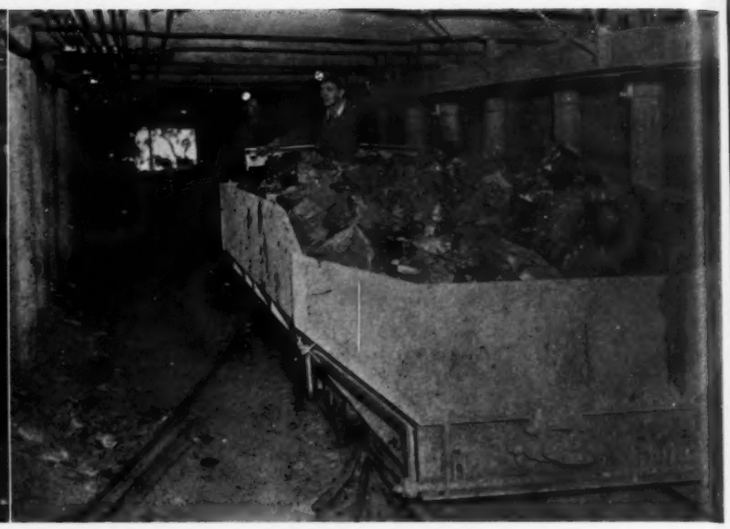

Skip Loads of Shale Moving to the Dump.

SHALE OIL PRODUCTION IN AUSTRALIA

ACCORDING to recent information about 600 tons of oil shale a day are being mined at Glen Davis, in Australia, from which there are obtained 1,700 bbl. of crude shale oil, with a yield of 30,000 to 35,000 bbl. of gasoline a day.

The Glen Davis oil shale mine is located in the Walgan Valley of the Blue Mountains somewhat less than 100 miles west of Sydney. The existence of the oil shale deposits was known from early times. Some 40 years ago an attempt was made to mine and process the shale at Newnes. In spite of some government assistance, production costs were too high to admit competition with natural petroleum and the Newnes project was shut down in 1922. In 1938 the Commonwealth government took over the mining option and established the National Oil Pty. Std. A new mine was opened by this concern at Glen Davis, where the seam of oil shale is four feet thick, double the thickness of the seam at Newnes on the other side of the mountain. A model town was established, the population of which is expected soon to reach 4,000 people. The plant, with its tank farm, covers an area of about 50 acres. About 800 men are now employed at Glen Davis.

The mine runs about one mile into the mountain and is completely mechanized. The shale is mined with electric cutters in large lumps; the skip loads are brought out by an electric locomotive and dumped in a pile at the mine mouth.

The shale is then crushed and distributed among 108 retorts which are fired by gas produced in the dry distillation process. The crude oil produced from the retorts is piped into a million-gallon storage tank from which it flows to a modern cracking plant. The oil is cracked at 800° to 900° F. under a pressure of 600 lbs. to the square inch and the cracked products are separated by fractionation in the conventional manner.

The National Oil Pty. will soon begin construction of a 140-mile pipe line to bring the product to a distributing center at Blacktown near Sydney.

New South Wales Premier Inspects a Furnace.

Tank Farm Where Oil is Stored Pending Shipment.

Photos from Three Lions

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Entering another year of service to the petroleum industry, Axelson renews its pledge to maintain as it has for the past half century the highest standards of design, engineering, craftsmanship and materials.

These high standards can be maintained because of the very important fact that Axelson at all times controls within its own organization practically every process of manufacture from raw materials to finished product With such control in the hands of veteran Axelson employees, many of whom have been with the company for the better part of a lifetime, there is no chance of failure Even during these hectic war days, with all the difficulties of priorities and material scarcities, Axelson never for a moment has compromised either quality or workmanship.

Axelson equipment continues to be built. Never during all the strenuous war difficulties has there been a let-down at Axelson's. When material priorities were causing shortages, Axelson designers, engineers and master craftsmen figured out a better way to do the old job. Now that restrictions have relaxed somewhat on oil industry equipment, Axelson is able to speed up more. But always we adhere to our standard of fifty years: there is no substitute for Axelson quality.

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The reason Axelson gray iron castings have achieved such a high standard of prefection is due to the "controlled" processes of production. Engineering, chemistry, metallurgy and every other scientific method of control is used.

Accurate gages are essential to many manufacturing processes. For many years Axelson has developed and built the finest precision gages it is possible to produce. Innumerable tests are made during the building to insure accuracy and perfection.

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GRAY IRON CASTINGS • RING AND PLUG GAGES

Interchangeable Pumps for International Service

Continued from page 49

the Holiday recess. But Thomas now has backed away from the simple idea of boosting crude prices and proposes to involve it with tax legislation. He plans joining with an 85-cent hike a provision for stepping up the Federal tax on gasoline from 1½ to 2 cents. The Senator's theory is that any direct attempt to enact a higher price is "doomed to failure." I.P.A.A. is cold to Thomas' tax proposal and notified him they were against it. Meantime oil price proponents are looking for a Senate leader who will push the fight with more confidence.

The crude price question, aside from the legislative method of getting an increase, is back in the lap of Economic Stabilizer Vinson. Ickes has definitely notified Vinson that he has been unable to find any workable subsidy plan to stimulate drilling. Oil men are wondering whether Vinson will come forward with a subsidy idea of his own, and if so what. Prospects are, however, that the White House will let crude prices rest where they are, at least until the labor and other more politically potential problems are out of the way and more pressure than has heretofore been exerted is generated.

Congress Looking at PRC

THUS far little attention has been paid by Congress to the planned activities of Petroleum Reserves Corporation for putting the government into the international oil business, possibly because PRC President Ickes has met with no success in his efforts to get oil companies to accept the government as a partner in their operations. Some members are beginning, however, to display curiosity as to PRC and the possible consequences of edging into a field that has been tilled exclusively by private industry which is held to have done a pretty good job in such a competitive business.

The House oil investigating committee is showing an interest in PRC and probably will go into the matter with a series of hearings. On the Senate side of the Capitol, introduction of a joint resolution calling for the dissolution of PRC is to be looked for. In some quarters question has been raised as to the legality of PRC's charter, the claim being made that RFC Chairman Jesse Jones lacked the authority to create such a corporation. Bitterest antagonist of PRC on the Hill is probably Senator Ed Moore of Oklahoma, who says:

"The creation of the Petroleum Reserves Corporation is a shocking affront to our concept of private enterprise. Not only this, but it is an instrumentality which may readily involve this government in dangerous and entangling difficulties with foreign governments. The ownership by the United States government of property interests in other countries will be a growing source of future international disputes and will contribute to those international feelings which help to arouse national pride and hatred and bring about wars. Such action is not compatible with the announcement of respect for complete sovereignty and integrity of all nations."

Moore takes issue with the argument that PRC is necessary to assure a supply of oil for this country's civilian and military needs.

"There is not a barrel of discovered or undiscovered reserves, wherever it may be stored under the earth's surface, that can be searched out and produced any more quickly, economically, or more capably, by government than by private industry under our system of traditional freedom of private enterprise," declares the Oklahoma Senator who always upholds Jeffersonian principles.

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Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing with Technical and Economic Aspects of the Petroleum Industry—Edited by Dr. O. W. Willcox.

OPERATION

Plastic Plug Backs—J. E. Bailey and Chas. E. Dimit, before AMERICAN PETROLEUM INSTITUTE, East Texas Chapter, November, 1943.

For about a year, plastics have been used instead of cement to plug off water in wells in the East Texas field, using only the dump bailer method. The plastic employed for this purpose is similar to the product used in making bakelite. As first made, this material is a liquid which has the property of changing from the liquid to the solid state on application of heat; the higher the temperature the quicker the change, and conversely. The East Texas field has a bottom-hole temperature in the neighborhood of 145°, and at that temperature the change to solid takes about 12 hours.

An important property of this liquid is its ability to penetrate porous bodies, such as a sand formation. The procedure is to select the spot to be plugged. A service company then dumps about 10 gallons on bottom, and after this has hardened, another batch is added, and so on until the desired fill is obtained. The degree of penetration into the formation is governable to some extent by pressure applied at the surface. Up to September 1943, about 132 of these plastic plugging jobs have been done. As in all such operations success depends on the completeness of the available information about the individual well and it history.

In several instances operators have had 100 per cent success in shutting off water with 7 ft. of sand exposed, with no protective shale breaks, by plugging off all but 1 ft. Success of these marginal jobs is attributed to the penetration and bonding qualities of the plastic, characteristics not so prevalent in cement plugback jobs.

Detailed information is available on only 12 plastic plugback jobs performed on wells having from 3 to 7 ft. of exposed sand section. Of these 12 jobs, 7 were successful, 3 partially successful and 2 were failures. Of 19 wells plugged with 3 to 10 ft. of exposed sand section there were 11 successful jobs, 5 partially successful and 3 failures. Of 32 platic jobs with from 3 to 15 ft. of sand section 22 were successful, 7 partially successful and 3 failures.

Twelve plastic jobs were performed on top of cement plug failures. Of these 12 jobs, 8 were successful, 3 partially successful and 1 failure. There were 4 jobs attempted through liners in the hole, 3 of which were successful and the results of the fourth job are not available.

In no sense should cement plugback jobs be relegated to unimportance as the necessity for the use of cement has not been overcome. Wells with great penetrations and large holes are deemed expensive in attempting to plugback with the plastics now available.

The Foaming Tendency and Stability of Crude Petroleum—W. H. Somerton, before American Petroleum Institute, 24th Annual Meeting, Chicago, November, 1943.

In any investigation of oil and gas separators, oil-well pumps, gas anchors, or any other device or process in which a foam condition may influence the efficiency and effectiveness of operation, a measure of the foaming characteristics of crude petroleum should prove of value. For example, the design of oil and gas separators in the past has been based principally on experience, whereas the modern trend in engineering design is toward the utilization of basic physical laws and sound engineering principles. Thus, the first factor to be considered in the design of oil and gas separators logically should be the character of the substance to be dealt with; i.e., the stability of the "gas-cut" oil or foam. Again, a study of the tendency of a crude-oil-gas system, of a particular zone or field, to foam may influence the type and size of the

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pumping installation to be employed. Other possible applications of a measure of foaming characteristics are numerous.

For measuring the foaming tendency of oils the author devised an appropriate laboratory equipment and used it in a study of various crude-oil samples with a wide range of physical properties. It was found that the foaming tendency and foam stability of an oil could be expressed as a "foaming tendency index," or ratio of total foam volume to the original volume of the gas-saturated crude at a designated pressure; it is an exponential function of the back pressure. The foams settle out in a nearly straight-line relationship with time, for an average of 70 per cent of the life of the foam.

The gas-oil foam systems examined appear to be inherently unstable; the foaming tendency is apparently more a function of the nature and composition of the foam system than of the physical properties of the oil, and foam stability is controlled primarily by the viscosity of the oil.

A New Application of Water Infection for Maintaining Reservoir Pressure and Increasing Natural Water Drive—Wm. L. Horner and D. R. Snow, before American Petroleum Institute, Chicago Meeting, November, 1943.

The most important objectives sought for any field are: 1, maximum ultimate yield; 2, maximum production rate per well at minimum cost per barrel. To attain these objectives, control of reservoir pressure is a factor of greatest importance. For this purpose, a method for maintaining original reservoir pressure by increasing the natural water drive was devised and is being practiced in the Midway Field, Arkansas. So far as known, this is the first instance in which injecton of extraneous water has been applied to an entire pool—and in the very early stages of its productive life.

This method should be applicable to many other newly discovered or partly depleted oil pools where a deficiency of natural water drive can be recognized or where reservoir conditions are such that artificial water drive could be applied.

Data from Midway Field, Arkansas, are presented which demonstrate a certain degree of control over pressure behavior in a large part of the reservoir by means of fresh-water injection. Reservoir pressures were increased in an area one mile in diameter during a period when withdrawals from the pool as a whole were considerably increased. Over the five-month period following initial injection, the average reservoir pressure for the entire field declined at a negligible rate, whereas until that time the average reservoir pressure had fallen at the rate of approximately ½ psi per day.

Construction of permanent facilities to inject the required volume of water into four input wells is under way in accordance with terms of an agreement between the operators in the field. The investment cost of the project, including the salt-water disposal system, will total approximately one-tenth of the development cost of the field.

USES

Method for Testing Cutting Oils—H. L. Moir, J. S. Yule, D. J. Wangelin and R. J. Moyer (Pure Oil Company), before Society Automotive Engineers, Detroit Meeting, January, 1944.

Tools used for cutting metals should have a reasonable length of life and produce a good finish. Tool life can be measured by the length of time required for it to need regrinding; finish life, or the time during which the tool produces a satisfactory surface, has been more difficult to judge. The authors, however, have invented an apparatus which they call a surface comparator and have used it to determine the suitability of various oils in the cutting of metals. Among the conclusions drawn is that the use of oil produces smoother chip flow than is obtained with dry cutting.

Active sulfur in an oil has the tendency to prevent seizure between the chip and the tool but requires sufficient heat to perform that duty. Chlorine in an oil increases the strength of the lubricating film and has the apparent ability to keep the chip and the tool lubricated. If the pressure becomes too great the film will be ruptured, causing a condition of seizure to be present. We can say that under light cutting operations where large rake angles are permissible that an oil should have a high lubricating quality. With heavy cutting operations where small rake angles are necessary the oil will be operating under greater heat and pressure and, therefore, should have a high anti-weld property. If active sulfur is present in an oil that is used for a light operation it will act as an abrasive and decrease tool life. For this reason it is important to select the correct oil for each job.

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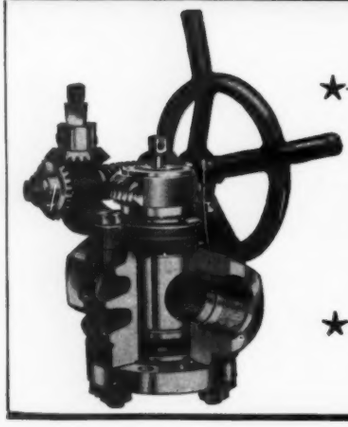

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NATURAL GAS

Survey of Underground Natural Gas Storage Projects in United States—Committee Report, INTERSTATE OIL COMPACT COMMISSION QUARTERLY BULLETIN, Vol. 2 (1943) No. 3, pp. 64-80.

This study presents much information regarding existing and planned underground storage projects for natural gas in Arkansas, California, Kansas, Kentucky, New Mexico, Ohio, Oklahoma, Pennsylvania and Texas. Thirty-four projects are mentioned in this survey, and it is stated that Pennsylvania contains 20 storage reservoirs in use, with five more being reconditioned for storage for possible use in the coming winter.

In commenting on these developments, the Committee says that the use of underground storage has played an important part in the war effort. Tremendous demands, resulting from the war effort, might not have been met in the Appalachian area during the past year and a half if the use of underground storage had not come into common practice in recent years. These demands, particularly on peak days, were so great that it would have been impossible in the past two winters to have supplied all of the essential markets with gas if storage had not been available.

The salvation of the natural gas industry in the East has been the use of underground storage. Conservation has been furthered because it is possible to transfer gas into storage from highly competitive areas where flush production might encourage uneconomical use of the product on account of a need for an immediate market. Underground storage has also been the boon to the small stripper production of many of the Appalachian gas wells which can only be operated economically if they are used 365 days a year, since their daily production has been greatly reduced in recent years. The abandonment of many small wells, with consequent lack of total depletion of the area and the resulting loss of this reserve for any practical use, has been avoided because these wells can now be produced with at least a small profit by using them every day in the year and permitting their production to go into storage in summer periods when there is no demand for the gas.

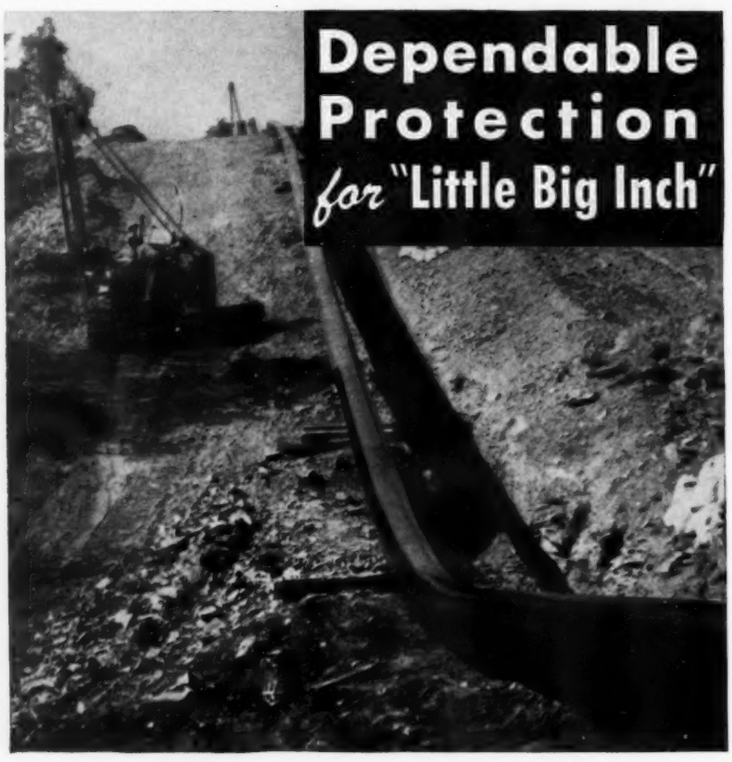
High Pressure Absorption of Low-boiling Hydrocarbons—C. G. Kirkbride and J. W. Bertetti in Industrial Engineering Chemistry Vol. 35 (1943) No. 12 PP 1242-1249.

In recent years there has been active interest in various methods of recovering distillate from high-pressure gas fields. This is particularly true of the Gulf Coast Region, inasmuch as state regulations have been established which do not permit wasteful processes for recovering the distillate. The regulations necessitate returning the residue gas to the reservoir from which it originated, unless the gas can be sold for a useful purpose. By returning lean gas to the reservoir, the pressure on the formation is maintained at the maximum, and there is very little loss of distillate due to retrograde condensation on the sand in the formation.

The return of lean gas to the reservoir entails considerable compressor capacity which is dependent upon the difference in pressure between the input wellhead and that of the lean gas before compression. It is desirable from the standpoint of maintaining compressor capacity at a minimum to carry out the recovery of distillate at as near wellhead pressure as possible. If retrograde condensation alone is used to recover the distillate, the separator pressure will ordinarily be about 500 to 1000 pounds per square inch at maximum distillate recovery. This leaves much to be desired since the wellhead pressures of many of the distillate fields are in excess of 3000 pounds; however, if higher separator pressure is used, the recovery of distillate declines rapidly. Furthermore, even at the optimum separator pressure, the efficiency of distillate recovery is not so high as desired.

High-pressure absorption, on the other hand, is a method which should permit more efficient recovery of distillate at higher pressure. The design of high-pressure absorbers, however, requires a knowledge of phase equilibrium at high pressure in systems with various types of lean oil. The authors made an extensive experimental study to obtain a basis of design for high pressure absorption and state their conclusions as follows:

Equilibrium constants are reported for methane, ethane, propane, n-butane, and n-pentane in three types of absorbing oil. The range of pressure was 125 to 3100 pounds per square inch, and the average temperature about 85°F. The three types of absorbing oil were paraffinic, naphthenic, and aromatic. The equilibrium constants at a given pressure and tem-



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perature are dependent upon the type of lean oil used. For the same pentane recovery at pressures about 1500 pounds per square inch the naphthenic type lean oil should absorb less methane than the naphthenic. A higher lean oil rate would be required for aromatic type than either naphthenic or paraffinic, but the lean oil loss by vaporization into the lean gas with aromatic type would vary between 67 and 45 per cent of that for the paraffinic type at pressures of 1500 to 3000 pounds, respectively. At pressures aroun.l 125 pounds the paraffinic type lean oil is superior, both with respect to volume of lean oil required and to less methane absorption for the same pentane recovery.

CHEMISTRY

Hydrocarbons in the Gasoline Fraction of Seven Representative Crudes—A. P. Forziati, C. B. Willingham, B. J. Mair and F. D. Rossini, before American Petroleum Institute, Chicago Meeting, November, 1943.

This paper is the second report of an investigation on the analysis of the gasoline fraction of representative crude petroleums by API Research Project 6 at the National Bureau of Standards. The samples for analysis were selected so as to cover the largest possible range in composition; included one high in aromatics, one high in *iso*paraffins, one high in normal paraffins, and one high in naphthenes (cycloparaffins); and came from the following fields: Ponca, Okla.; East Texas; Bradford, Pa.; Greendale-Kawkawlin, Mich.; Winkler, Texas; Midway, Calif.; Conroe, Texas. The fractionating processes of adsorption and distillation were used in the analysis.

Data are given on the amounts of the individual hydrocarbons (paraffins and naphthenes, 40 to 102 deg C, and aromatics to 160 deg C) in the gasoline fraction of the 7 naphthas.

On the basis of the data obtained in the present investigation, the following conclusions may be drawn with regard to the composition of the gasoline fraction of different petroleums, to 102 deg C for paraffins and naphthenes and to 160 deg C for aromatics. The extent to which these conclusions may be applied to higher-boiling material will be determined by the studies now in progress.

The gasoline fraction of different crudes may be characterized by specifying the relative amounts of paraffins, alkyl cyclopentanes, alkyl cyclohexanes, and aromatics.

The gasoline fractions of different crudes are composed of the same hydrocarbons, the differences from five classes of hydrocarbons: normal paraffins, *iso*- one crude to another being essentially in the relative amounts of the foregoing five classes of hydrocarbons. Within each of these five classes, the individual hydrocarbons occur in proportions which are of the same order of magnitude for different naphthas.

It appears possible to predict the order of magnitude of the amounts of the individual hydrocarbons, paraffins, and naphthenes, 40 to 102 deg C, and aromatics to 160 deg C, present in an appropriate fraction of a given naphtha when there are known the relative amounts of the foregoing 5 classes of hydrocarbons, or, alternatively for each class, the amount of one of the main components of that class.

PHYSICS

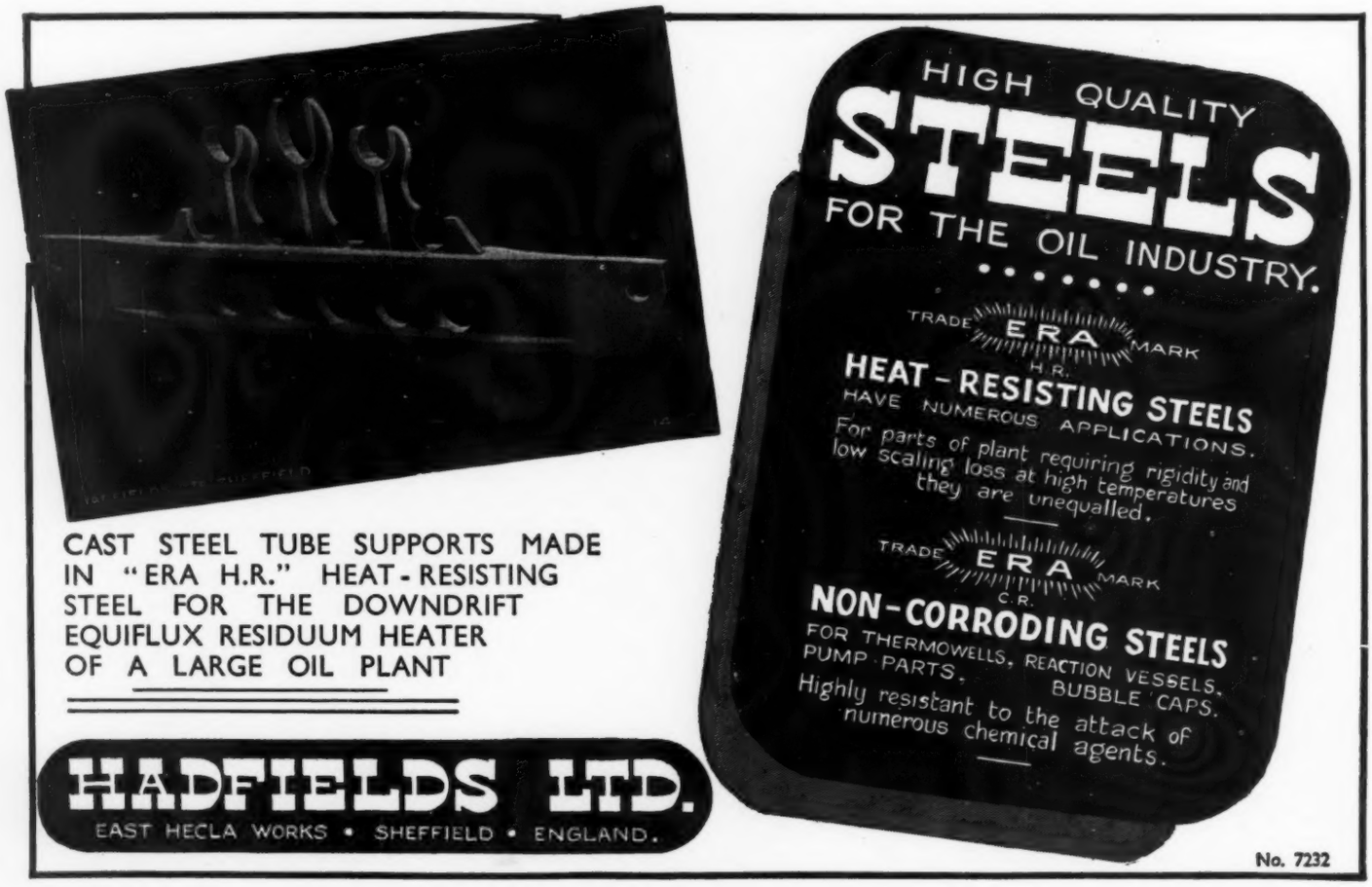
Synthesis and Properties of Hydrocarbons of High Halecular Weight—R. W. Schiessler, D. G. Clark, **Molecular Weight**—R. W. Schiessler, D. G. Clark, C. S. Rowland, W. S. Sloatman and C. H. Herr, before American Petroleum Institute, Chicago Meeting, November, 1943.

The work during the past year of American Petroleum Institute Research Project 42 at The Pennsylvania State College on the synthesis and properties of hydrocarbons of high molecular weight is summarized in this paper.

Twenty-four new hydrocarbons ranging in molecular weight from 326 to 479 have been prepared, making a total of 66 pure hydrocarbons of high molecular weight reported by this project since its inception in July 1940.

Tentative generalizations regarding the effect of chemical structure on the physical properties of an oil are summarized as follows:

Both viscosity and viscosity index are increased by increasing molecular weight, basic molecular sym-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metry remaining constant. Preliminary results indicate that aromatics and naphthenes containing one cyclic group per molecule exhibit greater viscosity and viscosity-index increases for a given increase in molecular weight than do the corresponding isoparaffins.

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The density of saturated hydrocarbons is increased by increasing molecular weight, molecular type and symmetry being constant. Both cyclization and aromatization increase density. Progressive cyclization of a molecule to phenyl groups yields a much greater density increase than the formation of cyclopentyl or cyclohexyl rings. For a given percentage carbon atoms in naphthenic rings, cyclopentyl groups are more effective in increasing the density than are cyclohexyls.

Increase in molecular weight results in increased aniline point, molecular type, and symmetry remaining constant. The average rise in aniline point per additional carbon atom for saturated hydrocarbons is approximately 1.6 deg. C, as compared to about 2.1 deg C for monoaromatics in this molecular-weight range. Cyclization invariably results in decreased aniline-solution temperature, molecular weight being maintained.

The boiling point of hydrocarbon invariably is increased by increasing molecular weight, molecular type and symmetry being constant. Cyclization invariably increases the boiling point; the increment for a given percentage carbon atoms in cyclohexyl rings is approximately equal to that for cyclopentyl rings. Further, the boiling-point increment per additional ring for these naphthenics is apparently unaffected by the number of rings per molecule.

Permeability as Related to Productivity Index—Norris Johnston and John E. Sherborne, before American Petroleum Institute, Chicago Meeting, November, 1943.

The variables affecting the radial-flow formula are discussed quantitatively. The importance of reservoir viscosity of oil is shown to be equal to that of sand permeability itself in determining flow. A modified specific productivity-index function is developed which bears a simple theoretical relationship to sand permeability. Pertinent data are tabulated on 141 California oil wells on which thorough core-analysis and productivity-index data were available. The modified specific productivity index function is studied graphically for these wells. The conclusion is reached that, although the well behavior for high-permeability sands approximates the theoretical, there is an increasing deviation between actual performance and theoretical with decreasing permeability. The spread of individual well performance from the average California SPI-k curve may be accounted for by deviations between air and water permeabilities, variable spread of permeability values, by varying stages of reservoir depletion, and by varying efficacy of well completion. It is expected that these variables will be studied further as more data become available.

Gravity Drainage in Oil Fields—James O. Lewis, in PETROLEUM TECHNOLOGY, September, 1943; Technical Publication No. 1616; 22 pages.

Gravity is an everpresent force in oil fields that will drain oil from the reservoir rock from higher to lower levels wherever it is not overcome by encroaching edge water or expanding gas. Gravity has always been recognized as one of the three main recovery agents but generally it has been dismissed as relatively unimportant, consequently study of it has been neglected.

Field evidence shows that in some reservoirs gravity has been effective and has resulted in recoveries equal to or perhaps exceeding what could be expected from water displacement. So far, effective gravity drainage appears to have been mostly unpremeditated and with little or no foreknowledge of the conditions and manner of operations most favorable for it. A study of the principles will disclose that gravity drainage can be applied more effectively and to more reservoirs than has accidentally occurred until now. These principles will apply particularly to the effectiveness of pressure maintenance by means of gas. In some field, the operator will have the option of using either naturally encroaching edge water or gravity drainage in conjunction with maintenance of gas pressure, therefore it is important to determine which is the more effective under a given set of conditions.

What proportion of our oil fields would be benefited by application of gravity-drainage principles is not known, and further investigations are needed. Petroleum engineers are urged to reexamine fields with which they are familiar and publish any evidences of gravity drainage for the benefit of the industry. As the behaviors of wells under water encroachment and gravity drainage may be similar until either water or gas reaches the well, it will become of interest to determine whether in fact edge water is the dominant agent.

REFINING

Recent Developments in Houdry Fixed Bed Catalytic Processes—T. B. Prickett and R. H. Newton, before AMERICAN PETROLEUM INSTITUTE, 24th Annual Meeting, Chicago, November, 1943.

The principal development in the Houdry process since the German invasion of Poland has been the change from natural clay to synthetic catalysts, the properties of which can be controlled with precision. This control has widened the application of catalytic cracking over a greater range of virgin stocks and hence has broadened the supply of aviation base stock, particularly in a two-step process. A large contribution to the war effort was possible because of the ability of Houdry units to furnish supplies of isobutane and butylene for alkylation, which, theretofore, were obtainable only from natural gasoline and thermal cracking plants.

During the war period there have been improvements in operating techniques, and also mechanical improvements that have lengthened on-stream time to about 90 percent; three of the newer static-bed

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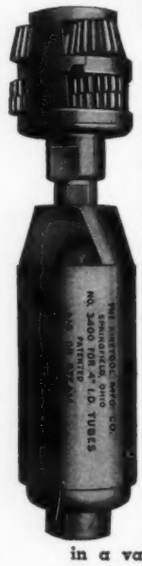

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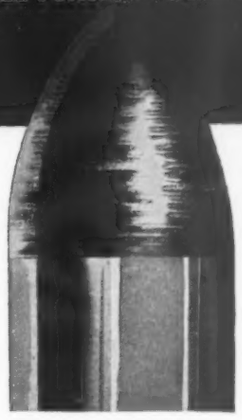

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plants have shown on-stream efficiencies of 96, 99, and 100 percent.

As with all catalytic processes, there is a gradual decline of the activity of Houdry catalyst. The first Houdry synthetic catalysts had an estimated life period of about 12 months: the newer ones have operated successfully for periods in excess of 15 months. On this basis a 10,000 bbl/day Houdry plant consumes an average of 650 lbs. of catlayst daily, or about one ounce per bbl. of charge.

In addition to reducing catalyst requirements, the inherent flexibility of the static bed process permits the conversion of a wide variety of charge stocks. Heavy gas oils crack readily, and unless conditions are carefully established there is an excessive loss of desirable products to gas and coke. Conversely, naphthas are refractory and require much more severe conditions to give the optimum results. In the various plants the operating conditions are selected for the several charging stocks by choice of proper catalyst activity, adjustment of pressure, and to a lesser degree temperature.

The most active commercial catalysts have more than twice the inherent activity of those of controlled low activity which are used for the heaviest gas oils. Oil partial pressures are varied from sub-atmospheric to seventy-five pounds per square inch gauge, and temperature is varied from 800° F. to 875° F. This wide flexibility in choice of conditions is of paramount importance in the cracking of both light and heavy stocks for the production of superior aviation fuels.

At this time the authors are not permitted to present significant data showing the advantages of the utilization of the combined cracking and treating processes for the production of aviation fuel. However, government regulations will permit disclosure of this information to persons who qualify under such regulations.

Cracking with Catalysts—C. L. Thomas, N. K. Anderson, H. A. Becker, and J. McAfee, before AMERICAN PETROLEUM INSTITUTE, 24th Ann. Meeting, Chicago, November, 1943.

During the past five years the fluid catalytic cracking process has received intensive study. An accelerated program of installation has been instituted because of the necessity of providing sufficient aviation-base stock. The catalyst used, of the so-called fluid type, is a powder intimately mixed with vapors in the reaction chambers. In general, the UOP catalyst is of the synthetic silica-alumina type, which has definite superiority as to yield and octane rating of the base stock over that of the natural clay type. The important process variables are temperature, pressure, space velocity, and length of process period; and these must be carefully controlled in order to insure the quality of the product. A table and a diagram are included to show the effect of operating conditions and conversion on product distribution.

Stocks with appreciably lower boiling points, such as kerosene, are more refractory and require more severe conditions; they produce stocks that are less olefinic than a typical gas oil. Conversely, heavier stocks are more easily cracked, and yield more, unsaturated products.

Higher yields can be obtained in catalytic cracking on recycle operation just as in thermal cracking. The methods of finishing the product include catalytic retreating, "polytreating," and sulfuric-acid treating.

Two types of commercial units are discussed: the single-stage unit and the two-stage unit. These units are characterized by considerable operating flexibility.

The single-stage fluid catalytic cracking plant consists of a regenerator and a single reactor; in such a unit the gasoline produced in a first operation may be rerun through the same apparatus, which involves lower calendar-day throughput, more tankage and discontinuity of operating conditions. These disadvantages are avoided in two-stage plants, which have two reactors and a common regenerator.

The raw-oil charging stock, usually gas oil, is preheated by heat exchange with a recirculating stream on the first-stage fractionating column; it then goes to the catalyst-to-oil heat exchanger, where it receives further preheat from a stream of catalyst which circulates between the exchanger and the regenerator. The primary purpose of this heat exchanger is to give a wide degree of flexibility to the catalyst-to-oil ratio on the first stage.

Any additional heat required by the reactor is supplied by means of a fired tubular heater, in which

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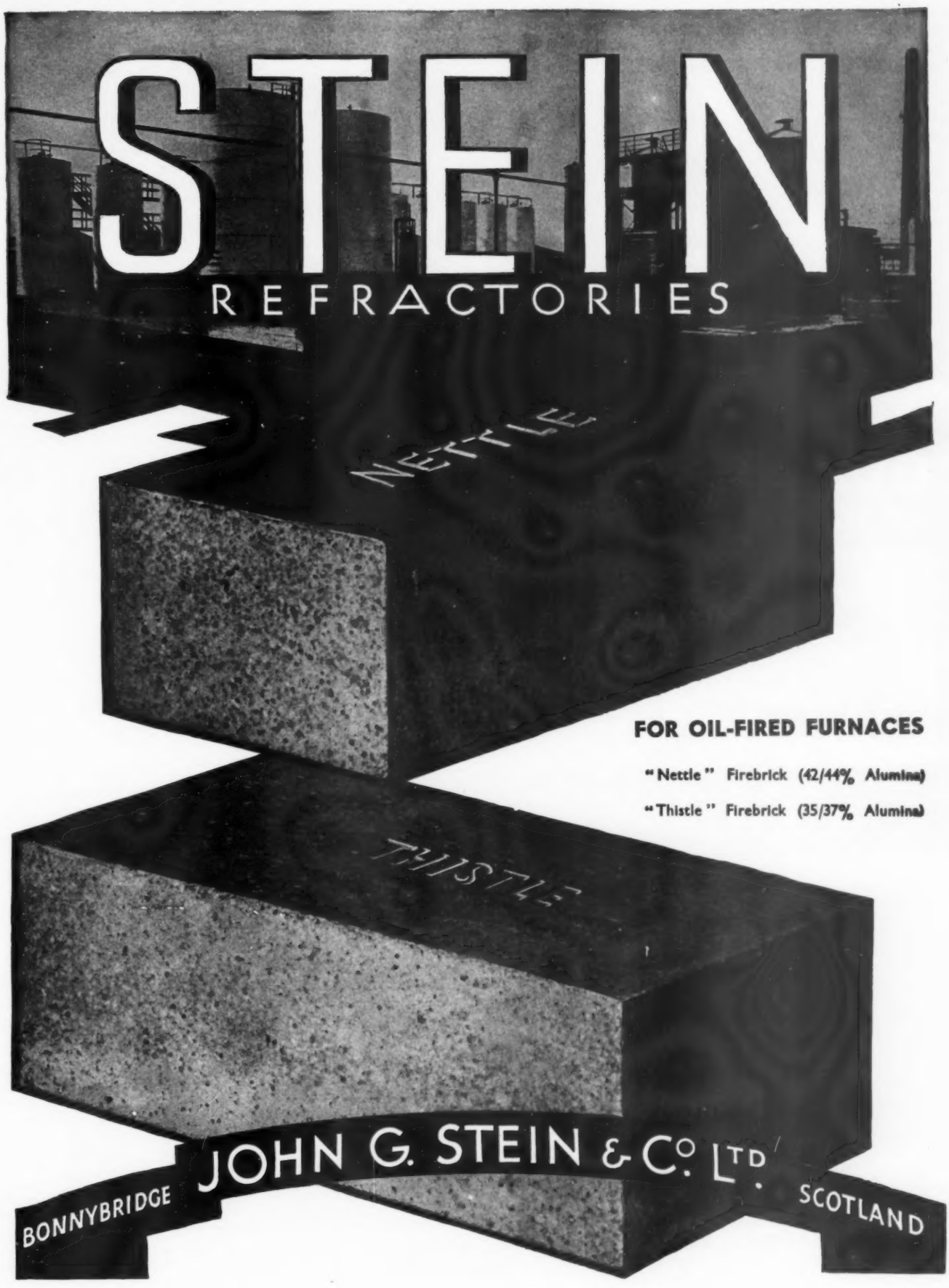
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the charge is heated further. The raw oil then enters the reactor riser, where it comes into contact with the hot regenerated catalyst flowing from the regenerator. The oil is now completely vaporized, and the catalyst is fluidized to a relatively light condition so that the mixture flows upward into the reactor. Usually recirculated process gas or steam is injected into the reactor riser to aid in fluidizing the mixture.

The products of the reaction are then fractionated in the first-stage fractionating column and gas-concentrating equipment, from which a gasoline cut is returned to the second-stage reactor for treating—usually at a somewhat lower space velocity and temperature.

Heat is furnished to the second-stage reactor principally by hot catalyst from the regenerator, the catalyst-to-oil ratio in this stage being relatively high. From the second-stage reactor the treated product passes to the second-stage fractionating and gas-concentrating sections for separation.

USES

Propane Instead of Acetylene—W. A. Kirkby, in Fuel in Science and Practice, Vol. 22 (1943), No. 3, p. 54.

The author considers the relative merits of propane and acetylene in the welding industry. A 56-lb. cylinder of propane is equivalent for metal cutting purposes to three 200-cu. ft. cylinders of dissolved acetylene, though calorific equivalence alone is not a sufficient basis for comparing the two gases as to efficiency for welding, etc. Differences in flame temperature, and probably in the mechanism of combustion, are important. A maximum flame temperature of 2,760°C. was noted when propane was burned in oxygen, and a temperature of 3130° when acetylene was burned. According to Stedman, the lower flame temperature and flame speed of propane are an advantage, appearing to produce more perfect oxidation and greater speed of cutting. There is a question, however, whether propane will give reliable welds with non-ferrous metals because many of them are liable to intense oxidation at high temperatures.

The reducing zone in the envelope of the oxyacetylene flame has an important effect in retarding the undesirable effects of atmospheric oxygen. The propane-oxygen mixture for maximum flame temperature is more difficult to adjust than the acetylene-oxygen mixture; but the propane flame does not strike back as easily and the speed of flame propagation is about a third of that of the acetylene flame.

Military Ground Forces Fuels and Lubricants—J. A. Richardson III, before National Fuels and Lubricants Meeting, Society Automotive Engineers, Tulsa, November, 1943.

A description is given of the various types of products now proved to be of value in military vehicles, and on the basis of experience the author makes the following prognostications on fuels and lubricants after the war.

Heavy duty type engine oils and universal type gear oils will be generally used after the war. Gear oils will be lower in viscosity than was previously customary in heavy duty automotive operation and thus absorb less power and operate at lower temperatures. In large gear trains operating at high speed the power lost due to churning the oil is quite appreciable, especially with high viscosity oils. A separate pump and circulating system for large automotive gear cases may become general practice to reduce this power loss.

Grease marketers and automotive industry will, doubtless, both see the advantage of using standardized semi-fluid greases wherever possible in automotive equipment and eliminate the need for highly specialized greases for special parts. Rubber bushings will replace even to a great extent grease lubricated bearings such as spring shackles and track linkages, especially where such mechanisms are in contact with dirt and water.

Gasoline motor fuel will have a volatility close to the present aviation type of fuel and be free from vapor lock, give better manifold distribution and good starting and warm-up in any weather, without the need for supplying gasoline of special volatility gasolines for the various geographical areas according to season. Octane number of the fuel will be progressively higher and new engine design will take full advantage of the newer gasoline.

Automotive Diesel fuel will be more volatile and will be generally cleaner.

Deterioration of Lubricating Oils—Joseph J. Jacobs and Donald F. Othmer, in Industrial Engineering Chemistry, Vol. 35 (1943) No. 8, pp. 883-889.

Lubricating oils must do more than lubricate modern engines. They must also seal piston rings, carry away carbon and soot, and cool the engine. To fulfill these requirements, oils must have a property for which there is no standard laboratory test—stability in use. The major reason that vegetable oils were discarded as industrial lubricants was that they broke down in use and produced gums, sludge, and corrosive acids. For many years mineral oils served satisfactorily because of their resistance to breakdown. However, the low clearances, high bearing loads, and excessive temperature of modern high-compression engines have increased the tendency to break down, particularly in high-speed Diesels where piston temperatures are especially high.

The breakdown is due primarily to oxidation and, secondarily, to cracking and polymerization. The products of the deterioration are deposited in the piston grooves where they bake to hard lacquerlike cement which may even freeze the rings and cause scoring of the cylinder walls.

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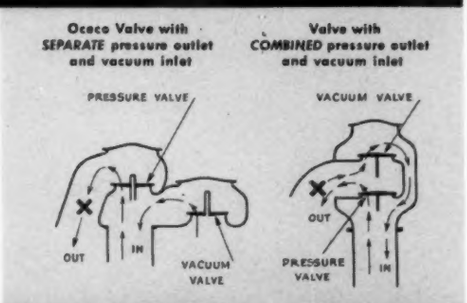

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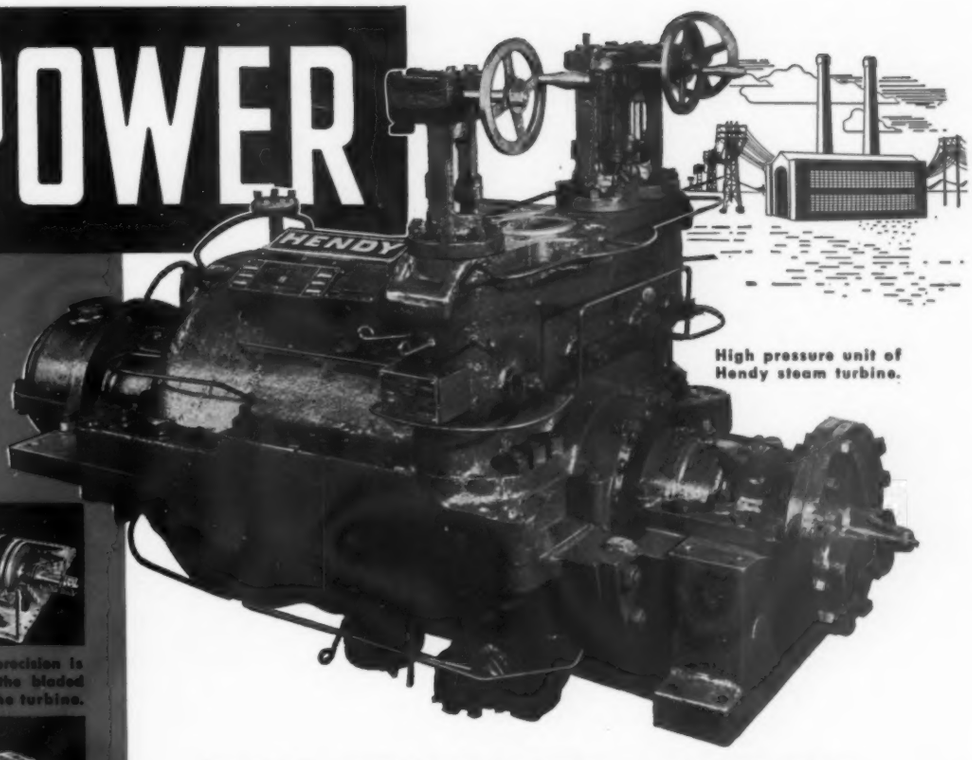

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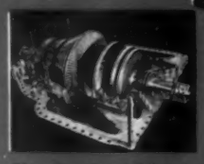

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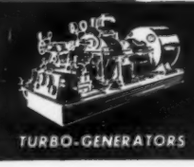

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Furthermore, bearing corrosion is increased greatly when the oil is badly oxidized to give corrosive acids. The formation of these acids has been a strong deterrent in the utilization of the new high-strength alloy bearings, such as copper-lead or cadmium-silver, even in automobiles where the duty is relatively mild. Many other effects have been attributed to degradation of the oil, such as piston skirt varnish, undercrown deposits, increased engine wear, and power loss due to the increased viscosity of the oil.

While it is possible to increase the stability of lubricating oils considerably by careful selection of base stocks and application of modern refining methods, there is a limit to the benefits which can be so derived. The petroleum industry has thus turned more and more to the use of additives to impart certain additional properties to lubricating oils. It is sometimes possible to obtain certain properties more cheaply by the use of additives than by refining, even when they may be so obtained.

In this paper the authors describe an additive that goes under the trade name of "Gliddol" which is obtained by blowing steam into solvent-extracted soy bean oil and recovering the precipitate by centrifuging. This material contains about 30 per cent of lecithin, 40 per cent of cephalin and 30 per cent of adhering soy bean oil that tends to stabilize the product against aging. It is a cheap material, costing about 30 cents a pound.

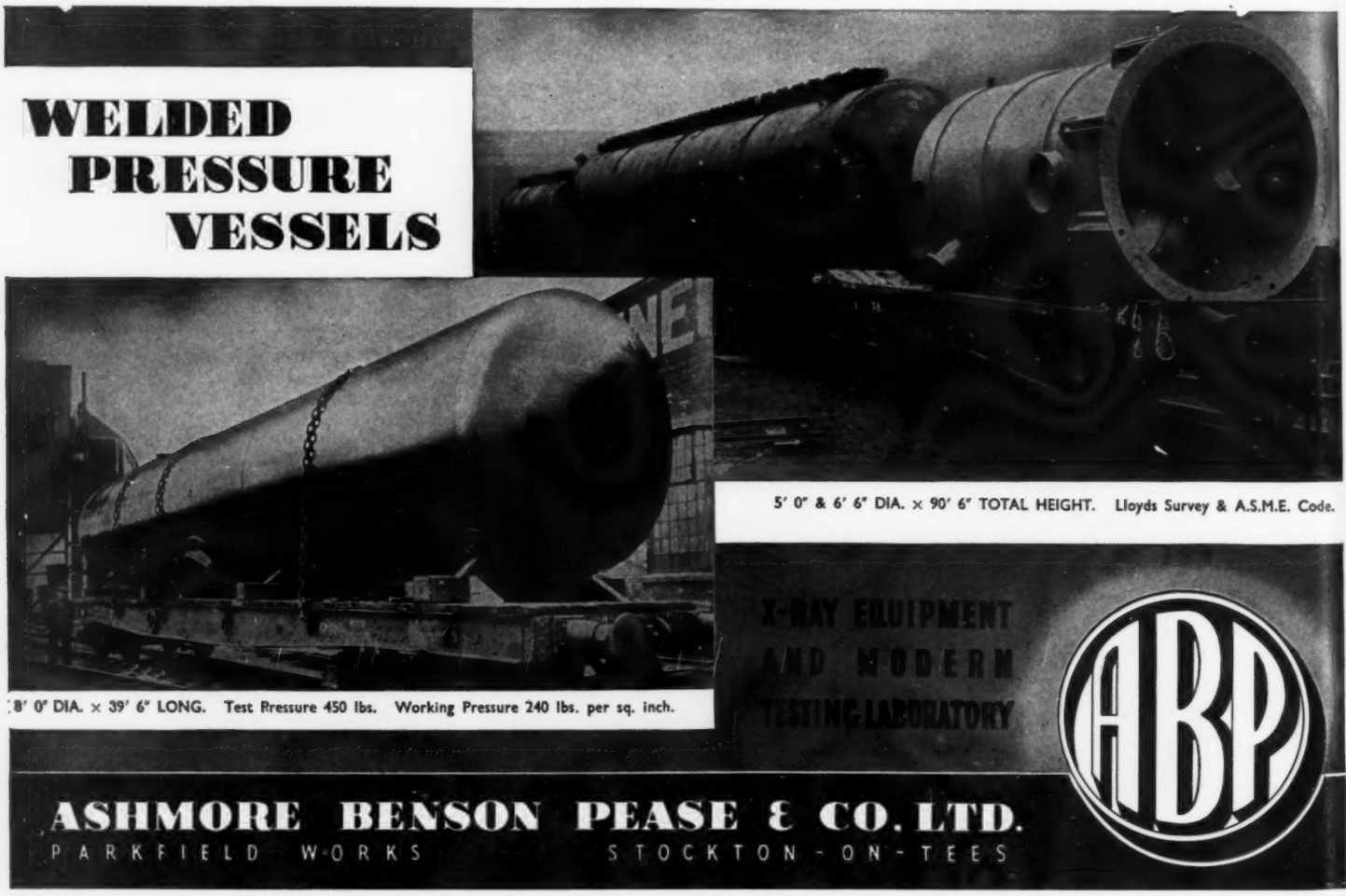
The authors report extensive tests which show that Gliddol is an oxidation inhibitor for lubricating oils. It reduces the amount of naphtha-insolubles formed, restricts the increase of viscosity, and reduces the neutralization number of the used oil. It is reported to be effective in oils from widely varying base stocks and in oils refined by widely varying methods. It has proved effective in oils of different viscosity indexes and compares well with other and more expensive commercially accepted inhibitors.

Barium Greases—W. L. McLennan, before National Lubricating Grease Institute, Chicago Meeting, November, 1943.

According to the author barium greases come the nearest to an ideal all-purpose grease of any yet developed. Tests indicate it can be used successfully for chassis, water pump, motor bearing and wheel bearing applications, under both high and low temperature conditions, and at high or low rates of shear, it was stated.

The base is made by adding excess barium hydrate to prime tallow and heating to 214°F. in a steam jacketed kettle to permit complete saponification. One-third of the desired amount of lubricating oil is then added, which, reacting with some of remaining barium hydrate, drives the temperature up to 375°F. by heat of reaction. The product is held at this temperature by cooling water circulating in the jacketed kettle. After reaction ceases, balance of the oil is added and the kettle contents are cooled to 210°F. The proper amount of water then is added, the resulting grease being worked to a smooth consistency. The water content is not critical, sufficient being added to keep the melting point high, but at same time giving good appearance and consistency to the product. Tallow, lard oil, cottonseed oil among others may be successfully employed in the base stock or the fatty acids themselves, as desired. Barium hydroxide concentration ranges from 40 to 60%. The type and viscosity of the mineral oil has a wide range, depending specifically on what properties are desired in the finished grease. The final product looks like a calcium-soap grease. The milled grease is particularly effective in bearings, as it does not break down, is non-fibrous and its water and temperature resistance are high. It thins out under heat about the same as calcium and sodium-soap greases. Oxidation resistance also is high, showing a 96-hour induction period without inhibitor in the Norma-Hoffman Oxidation Test. Its appearance after test is slightly darker and the grease is somewhat harder, but no other changes are apparent.

Several successful applications were presented. One was as a sealed-in lubricant on the rollers of drilling line anti-whipping or line-saving devices. The manufacturer's test was to run the lubricated roller to failure by high-speed belt-drive from an electric motor. While other lubricants permitted failure of the roller long before the electric motor gave out, rollers lubricated with the barium grease outlasted numerous belts and two motors.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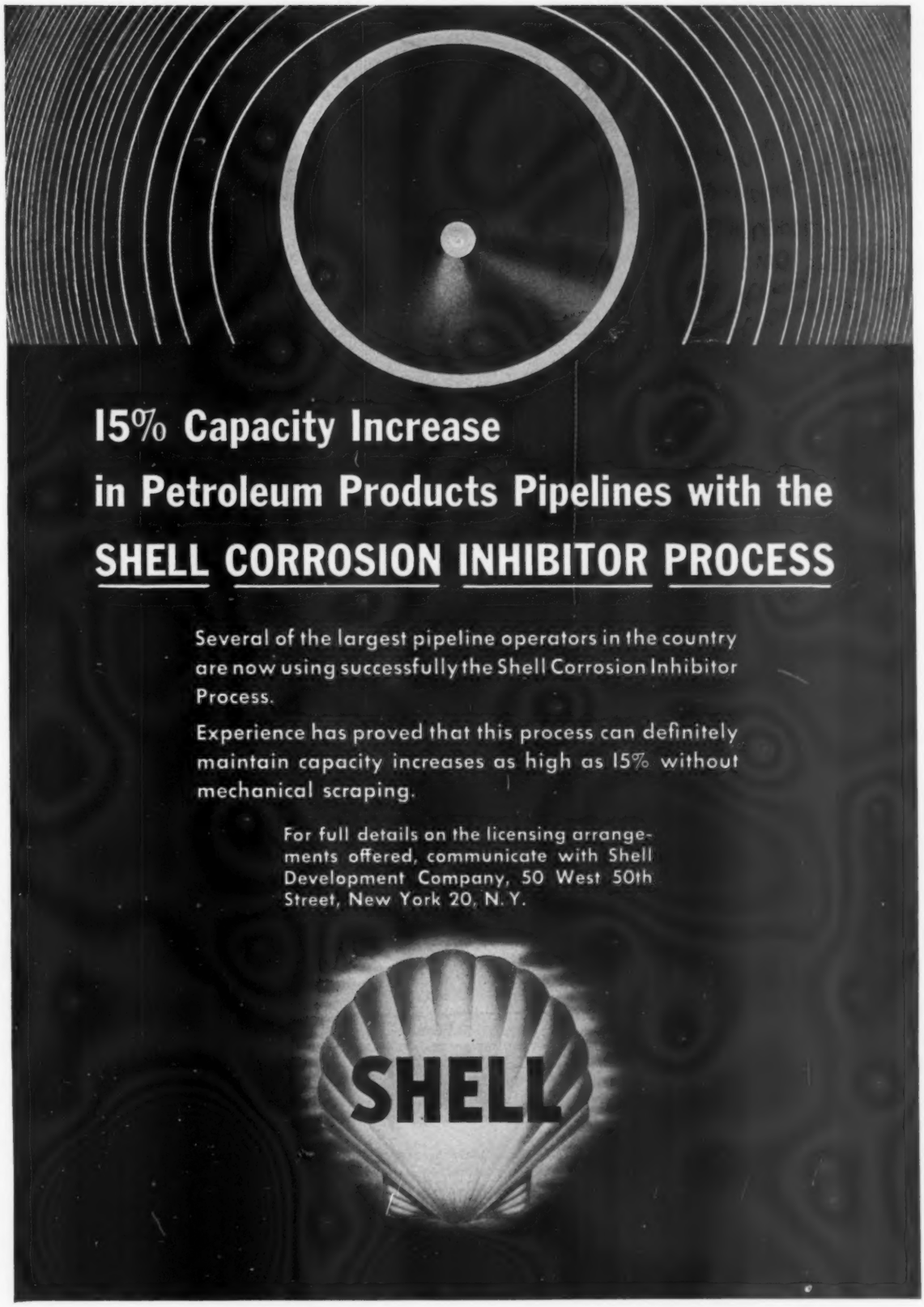
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GENERAL

Economic Development in the Fuel Industries—George A. Miller, before PETROLEUM ECONOMICS SECTION OF AMERICAN INSTITUTE MINING & METALLURGICAL ENGINEERS, 158th Meeting, 1943.

Among the fuel industries, petroleum has been called upon to make the most drastic adaptations not only to shifts in markets but also to changes in production processes. The petroleum industry has been required to undertake a vast expansion for providing high-octane gasoline, aviation lubricants, blending agents, butadiene, and toluene. These changes, however, represent only a partial conversion of the industry rather than a 100-percent shift. There has been no industry-wide stoppage of output of ordinary peacetime products, as in the automotive, household-appliance, and metal-specialty industries, to provide for a complete readjustment to unaccustomed types of war production.

Still, by far the most serious fuel problems of the war have been in the petroleum industry. Menacing shortages have occurred in the East Coast area north of Cape Hatteras and in the Pacific Northwest. Temporary and scattered shortages have occurred in the South Atlantic States, the Midwest, and the Rocky Mountain States. The industry has had difficulty in meeting extraordinary costs where subsidies have not been applied. It has had to take strong action to readjust refinery ratios for various products to meet shifts in petroleum demand, and it has undertaken a vast program for production of war products. Overseas trade, which is much more important for petroleum than for other fuels, has undergone drastic changes.

The coal industry has been beset by a large number of problems but none of them have been as serious as the petroleum problem of the North Atlantic area.

Natural gas was expected in some quarters to offer acute difficulties on the days of peak demands, but it has been discovered that natural gas consumption shows considerable elasticity so far as domestic consumers are concerned. Direct appeals to curtail have achieved good results. Capacity to meet natural-gas demands is peculiarly a problem of the peak days in the peak season. Normally the natural gas utilities sell part of their supply on interruptible contracts that permit cutting off deliveries during the peak periods. At present, the number of such contracts is abnormally small, with the result that the peaks have been accentuated. Additional natural-gas load is being added despite curtailment orders for new equipment applicable most rigidly to domestic heating. The largest shortages of natural gas supply have occurred in the Eastern Kansas-Missouri area and in the area served by the Appalachian fields. Extensive gas well drilling has helped to avert a critical situation in the latter area, but has met with less success in the former area.

For the year ahead, it appears probable that the shortage problem will shift markedly among the fuels. Very likely the petroleum situation will be eased by the double effect of rationing and other curtailment factors, and the introduction of new transportation facilities. If war output rises in line with our hopes and expectations, the coal industry very likely will experience increasing problems which will become most evident next winter. Natural gas also appears to be headed for more trouble as soon as the next heating season arrives.

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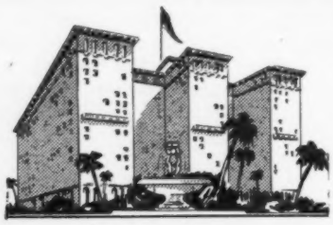
We may expect a new competitive struggle among the fuels in the post-war period. Coal has gained



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a relative advantage during the war. Meanwhile the technology of petroleum transportation has been advanced through the realization of the economic advantages of large-diameter pipe lines, through the construction of more efficient tankers, and through better handling of railroad movement. Similarly, in natural gas, more emphasis is being placed on the large pipe lines that make transmission economic for distances considerably in excess of a thousand miles, whereas a few years ago a few hundred miles were usually thought to be the limit.

GENERAL

What's Ahead (concerning automotive fuels) in 1953?—Carlton H. Schlesman, before New York Kiwanis Club, New York, December, 1943.

The author (head of research and development of general laboratories of Socony-Vacuum Oil Company) says that while the efficiency of automotive fuel can still be increased by further raising the octane number, it is well to remember that it is practicable to design the car of tomorrow to run at high efficiency on fuel of zero octane number.

High efficiency prime movers which are free from the requirements of high octane number fuels may be built in three ways. First, by use of modified cycles of operation. Diesel-powered trucks and busses are already giving a good account of themselves and we may expect such use to increase. The high cost of fuel in Europe after the war will give impetus to such developments for passenger cars. Second, the use of continuous combustion systems. A steam-driven automobile can be operated on fuel of any octane number. Similarly, turbine systems lend themselves to the use of fuels of low octane. For example, the fuel might be burned in flame at high pressure. Under these conditions, detonation is not a serious problem. The products of combustion would then be diluted with air and expanded into a turbine. A third and far more radical power plant is one already under development in which the fuel is burned inside of gas mantels so that radiant energy is produced at high efficiency. This energy impinges on photo-electric cells which convert it into electrical energy. This electrical energy is then employed to drive electrical motors located at the wheels. It is interesting to note that one of the important missing links in this evolution, the light-weight, high-powered electric motor, is now available for the first time. The latter system, when installed in a modern streamlined vehicle, promises almost unbelievable economy, perhaps 60 miles per gallon at 60 miles per hour. The important point is that such a power plant could run on No. 2 fuel oil as well as on 100 octane number gasoline.

It is also possible that these changes will stress the importance of lubricating oil far beyond any expression our experts have been willing to make to date. In fact, we cannot say now that the 1953 car will be lubricated with petroleum oil. Some very stable chemical may have taken its place. A more radical thought is that engines may be re-designed to operate on a water-base emulsion of the soluble oil type. Whatever form the lubricants of 1953 take they will be highly specialized, and their consumption will be substantially lower, probably in the same proportion as the consumption of gasoline.

Octanes or Cetanes After World War II—C. M. Larson, before Diesel Engine and Fuels and Lubricants Meeting, SOCIETY OF AUTOMOTIVE ENGINEERS, Cleveland, June, 1943.

After surveying the profound changes which the war effort has forced, apparently permanently, on the petroleum industry, the author pictures the octane-cetane fuel situation after World War II approximately as follows:

The so-called house brand or regular grade gasoline will be 80 octane, such as now used by the Army for all ground vehicles using gasoline.

The premium grade will be 87 to 90 octane, just above where Buick was when its design engineers had to cut back on octane requirements of the car.

The third grade gasoline will be 72 to 75 octane for the many serviceable cars left over after the war, that await obsolescence.

Tractor or distillate fuels of 50 octane or 40 octane will be available.

Kerosenes as known in the past will be had.

Of course, plenty of 100 octane aviation gasoline will be available but much of the material will find its way into the 80 octane regular, or the premium grade 88.

Diesel fuels will be available, but in many geographical areas the tractor distillate types of fuel will have to be used with low cetanes (37-40), or cetane additive agents will be added to maintain

Continued on page 81

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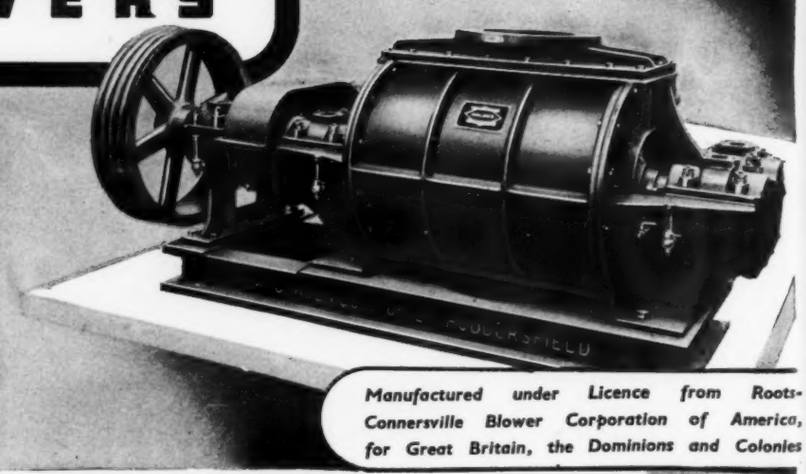

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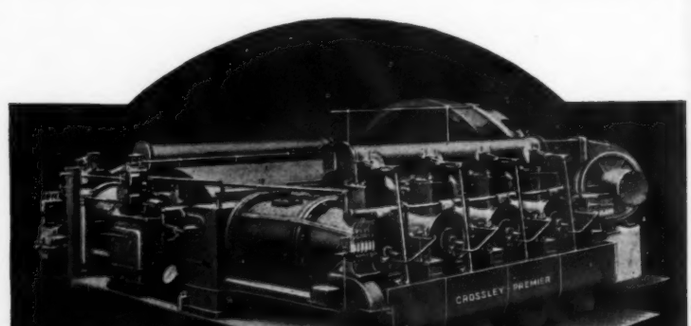

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An Automatic Distillation Apparatus for Gasoline Analysis—Lester Steffens and Donald P. Heath, before AMERICAN CHEMICAL SOCIETY, Pittsburgh Meeting, September, 1943.

Precise distillation is one of the major tools available for gasoline analysis, but operation at the necessary high reflux ratios results in a time requirement of as long as several weeks for distillation of a single sample. To expedite such work, an automatic distillate collector was constructed for use with a Podbielniak Super-Cal distilling apparatus, to permit continuous operation with a minimum of attention from the operator. Successive distillate fractions are measured in a float chamber and emptied automatically into bottles. The boiling point of the distillate is recorded continuously. The apparatus can be operated for a 16-hour period without attention from the operator.

BOOKS

Chemical Engineering Catalog, 1943-44; 28th Annual Edition—Published by Reinhold Publishing Company, New York—1513 pages, 8½ x 11".

As usual, this bulky publication brings information on all conceivable kinds of new and standard equipment used in the process industries—meaning those industries that may be included in a broad interpretation of chemical industry, which, of course, includes the petroleum industry. Besides listing the firms that manufacture equipment and chemicals and describing their products, the book has a technical data section, an extensive list of trade names and a descriptive list of more than 2500 books in English on chemical and related subjects. Everything that could interest users of processing equipment and chemicals is given a place in the classified indexes.

A.S.T.M. Standards on Petroleum Products and Lubricants—Prepared by A.S.T.M. Committee D-2, and published for AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; 442 pages—$2.25—issued September, 1943.

This annual volume brings in convenient form the 1943 Report of Committee D-2 on Petroleum Products and Lubricants. This volume contains the report of Section III on oxidation of turbine oils, a proposed method of test for saponification number of petroleum products by electrometric titration, a proposed method of test for oxidation characteristics of steam turbine oils, 76 standard and tentative methods of testing the physical and chemical properties of all kinds of petroleum substances. Standard and tentative commercial specifications for gasolines, solvents, and asphalts are given. There is also a glossary of terms relating to petroleum and to materials for roads and pavements.

LONDON OFFICE MOVES

THE London office of World Petroleum has been removed from Brettenham House, Strand, to 110 Fenchurch St. E.C.3. This is the original location occupied by the magazine in the early days of its publication. A. C. Hardy is now Director of the London office but no other changes are being made in the staff. British and visiting oil men will be heartily welcomed at Fenchurch Street and are invited to communicate with the offiice on any matters of interest to them.

The offices of Petroleum Times will remain at Brettenham House where they have been located since 1940. Mr. Hardy will continue as a member of the board of directors of Petroleum Times.

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